LIFE EXPECTANCY AS A DEVELOPMENT INDICATOR: LIAONING PROVINCE, CHINA, 2000

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ABSTRACT

The need to measure and compare development among or through countries and regions has led in recent years to the proliferation of numerous development indicators. Emerging from conventional one-dimensional economic, social, and health indicators, the Human Development Index (HDI) as a composite indicator, has drawn the attention of researchers and administrators alike. For China the HDI is available at national and provincial levels only, while at the sub-provincial level, for prefectures specifically, it has almost never been applied. Since its introduction the HDI has been plagued with doubts on its own methodology. This thesis shows that the HDI, in fact, does not provide any significant further information beyond that provided already by its composing indicators, namely, GDP per capita and life expectancy. The thesis shows, furthermore, that in China the HDI has no meaningful policy implication, because its numeric value disguises differences in education, economics, and health. It is likely for this reason, as well as due to the expense and unavailability of data, that China's Liaoning province has been using GDP per capita as the main indicator of regional development at the prefectural level. As a development indicator, however, GDP per capita has several deficiencies, which in this thesis are illustrated for the case of Liaoning province. A complement to GDP per capita as a development indicator is proposed here to be life expectancy for Liaoning's prefectures and for the urban-rural divide within prefectures. As such, life expectancy is shown here to be a useful indicator in the measurement of regional development, and a constructive tool for policy making and regional planning.

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LIST OF ABBREVIATIONS

BC: Biocapacity

CHDR: China Human Development Report

DAC: Development Assistance Committee

EF: Ecological Footprint

ESI: Environmental Sustainability Index

GDI: Gender-related Development Index

GDP: Gross Domestic Product

GEM: Gender Empowerment Measure

GNI: Gross National Income

HDI: Human Development Index

HDR: Human Development Report

HPI: Human Poverty Index

IALS: International Literacy Survey

IMF: International Monetary Fund

NBS: National Bureau of Statistics

OECD: Organization of Economic Co-operation and Development

PPP: Purchasing Power Parity

UNDP: United Nations Development Programme

UNESCO: United Nations Educational, Scientific and Cultural Organization

UNICEF: United Nations International Children's Emergency Fund

WHO: World Health Organization

CHAPTER 1
INTRODUCTION: DEVELOPMENT AS AN INTERNATIONAL, NATIONAL AND REGIONAL ISSUE

The meaning of the concept of development varies according to context. Once quantified through some conventional indices, the measure of development varies over space and time. Most succinctly put by Potter et al, "development relates to all parts of the world at every level, from the individual to the global" (Potter, Binns, Elliott & Smith, 2004, p.5). At an individual level, development may refer to one's physical and psychological growth and change. At a community level, from a social science perspective, development can refer to economic, social, and political progress that happen at a city, regional, national, and even international scale (Suhrke and Chaudhary, 2009). Whereas development is expected to lead to improvement and constructive changes in a region or a country, lessons have been learned in the past showing that poor choice in development strategies can lead to deterioration in living standards, increased poverty, and inequality (Székely & Hilgert, 1999). In certain cases economic development may have a negative impact in the sense of increasing the income gap among countries, regions, or various social groups.

Development as a subject of study linked particularly to the so-called Third World, had first emerged soon after WWII as a "product of confrontation between capitalism and communism as much as of their interaction" (Haslam, Schafer & Beaudet, 2009). In the post-WWII period, the United States along with other western countries came to be seen as the 'First World,' politically and socially contrasted with the 'Second World' socialist countries, led by the Soviet Union. During the same period of time, many ex-colonial African, Asian, and Latin American countries gained their independence and political freedom from some of the First World countries. In the early 1950s the French economist and demographer, Alfred Sauvy, classified these countries as the ‘Third World’. These countries were, on the one hand, in an economically disadvantaged position, but on the other hand they had emerged as increasingly significant on the global world stage. Third World countries were characterized as lacking financial and social capital to meet the needs of economic growth, seeking fiscal support and economic as well as military advice, alternately, from both the First and Second World (Haynes, 2008).

The theoretical idea of development is based on John Maynard Keynes’ economic theory in the 1930s. The Keynesian theory emphasizes the role of the state in the prevention of depression and recession, by utilizing macroeconomic policies based on government spending. According to Keynes, government investment in social and economic programs help countries strive towards an ideal economic equilibrium between high level of employment and social and economic capital of the state. In order to restore or speed up economic growth in less developed countries, in particular, the need for the injection of capital and the utilization of macroeconomic policies is entirely dependable on government involvement. Keynes, therefore, also favoured the state role in the provision of social services such as health, education, instituting unemployment insurance and public pensions. The modern notion of development is believed to have been introduced in 1949 by the former US president Harry Truman in a speech where he employed the term ‘underdeveloped areas’. Since then, the term has come to imply that criteria and standards can be used to measure and assess the level of ‘development’ for nations, and thus also to distinguish developed and less developed areas or countries (Haslam et al., 2009).

In the 1950s and 1960s, development was seen as equivalent to economic growth and a synonym for modernization and industrialization (Haynes, 2008; Thomas, 1999). This development concept began to change when both researchers and governments realized that growing income was only a means to a more ultimate goal, namely quality of life and well-being. Accordingly, welfare and social services came to be seen gradually as part of development. In 1987, sustainable development was introduced by Brundtland Commission as a concept of "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland Commission, 1987). In 1990, the concept of human development was first introduced by the UNDP in its HDR. Human development can be defined as "a process of enlarging people's choices", namely, long and healthy life, better education, and a decent standard of living (UNDP, 1990, p.10). Over the years, the concept of human development has gained prevalence and has been widely used to measure and compare the level of development among regions and countries (Lai, 2003; Yang & Hu, 2008).

From economic development to social development, from sustainable development to human development, it seems like development is ubiquitous. However the question remains: what is the true definition of development? According to Hettne, "there can be no fixed and final definition of development, only suggestions of what development should imply in particular contexts" (1990, p.2). McGranahan (1972) claims that "one of the simplest and most common conceptions of development is in terms of progress towards any or all of a list of national goals or values in the economic and social fields". Additionally, Gunnar Myrdal (1974) suggested that "development is the movement upward of the entire social system." Another scholar, Jeffrey Haynes (2008, p.17) pointed out that the essential components of development "was the need for poverty reduction and, by extension, accretions in the mass of ordinary people's well being."

In order to measure the development of a country or region, the United Nations as well as national statistical and economic organizations throughout the world has adopted in past years several indicators. An indicator is a "quantitative or qualitative factor or variable that provides a simple and reliable means to measure achievement, to reflect the changes connected to an intervention, or to help assess the performance of a development actor" (OECD-DAC, 2002).

In general, these indicators can be categorized as either objective or subjective based on the nature of the data; simple or composite based on the number of variables. Objective indicators measure development through quantitative statistics data; subjective indicators measure development and wellbeing through individuals' perception and feelings (Conceição & Bandura, 2008). Simple indicators only embrace one variable and measure one dimension of development, while composite indicators include two or more variables and measure development in multiple dimensions.

Development measurement in the 1960s used to be solely focused on fiscal comparison by using the GDP (Schimmel, 2009), as it was believed that technological and economic achievement could eliminate poverty and improve quality of life (Castro & Farmer, 2004). Yet GDP has been found inadequate to measure overall development, precisely ignoring or omitting measures of quality of life, since economic growth does not necessary reduce poverty, for example. Past criticism pointed out that economic performance is at most, only a proxy of development, rather than the ultimate goal of development (Hamilton, 1999; Lawn, 2003). In the late 1960s, social indicators as non-market measure of wellbeing became prevalent following publication of the book *Social Indicators* (Bauer, 1966). In 1978, WHO and UNICEF suggested that health indicators, rather than GDP should be considered as the center of development. Unlike GDP, health indicators are the direct observation of people's living experience. Hence, primary health care movements such as promoting maternal and child health, nutrition, family planning, water sanitation, control of infectious diseases, and health planning were advocated in North America and Europe since the 1980s. Over the years, people-centered considerations have become a crucial feature in development policy making and program assessment for various countries and international organizations (Castro & Farmer, 2004).

The idea of combing economic and non-economic indicators to measure various levels of development had been introduced, possibly for the first time, by Drewnowski and Scott in 1966, through their notion of ‘level of living index’. Later this was enhanced by McGranahan et al. into the ‘development index’ in 1972, and by Morris into the ‘physical quality of life index’ in 1979 (McGillivray, 1991). A composite indicator attempts to aggregate selected economic, social, environmental or political indicators into one single index. One of the most often used composite indicators in recent years is the HDI. As a composite indicator, HDI assigns 1/3 equal weight to its three sub-indices, namely, the economic, educational and health development indices. HDI, however, has been heavily criticized on its dubious weighting, inconsistent methodology (Anand & Sen, 2000; Booysen, 2002; Lind, 2010; Saha, 2009), redundancy (Booysen, 2002; Ogwang, 1994; Stapleton & Garrod, 2007), and ignorance of inequality and environmental impacts (Sagar & Najam, 1998).

Besides the annual HDR, the UNDP also publishes HDR on specific regions and countries of special interest. For example, the UNDP has published six CHDRs for the years 1997, 1999, 2002, 2005, 2007/08, and 2009/10. These reports present assessment of human development for mainland China at the provincial level.

1.1 Research Problem: HDI as a Development Indicator

In the present research, ‘development’ refers to the UNDP concept of human development and the UNDP’s HDI is the main focus of the current development indicator study. Early research on the HDI focused mainly on national comparison of human development. However, a growing body of literature has emerged in recent years addressing the application of the HDI at sub-national and sub-regional levels in various countries (Khalifa & Connelly, 2009; Shahbaz, Aamir, & Alam, 2009). Some scholars believe that HDI can be used as an indicator to measure human development for sub-national regions, namely, states, provinces and cities (Wang & Chen, 2009). Others point out that it is difficult for local government such as municipalities to gather data and information to meet the methodological requirements of the HDI calculation (de la Torre & Moreno, 2010).

It is still an open question whether HDI is applicable as a sub-national development indicator. The issue of HDI applicability at the sub-national level is particularly acute in the case of People's Republic of China. With one fifth of the world's population and second largest global economy, China's economic, social and human development has drawn increasing attention. China's economic reforms, which started already in 1978, and the ensuing fast economic growth, have led to severely imbalanced development and regional disparity within the country (Whyte, 2005; Wong & Lee, 2000). Diverse geographical conditions, varying economic programs and policies, and China's state-controlled household registration system (*hukou*) are some of the major factors behind China's unequal development throughout regions and social groups (Fan, 2001).

According to the UNDP data, between 1990 and 2010, the ranking of China's national HDI has improved dramatically. One of the major critiques of the HDI, however, is its disregard for inequality at the sub-national level (Sagar & Najam, 1998). The question therefore remains as to whether HDI displays the true development level of China and its provinces.

Previous research had also concluded that the components of the HDI at the sub-national level are highly dependent on each other (Cahill, 2005; Stapleton & Garrod, 2007). This problem relates to the larger issue, namely, that the HDI reveals nothing new beyond its own component measures (McGillivray, 1991).

At China's sub-provincial level, there is no HDI data available. GDP per capita has been the dominant development indicator for sub-provincial level governments. The deficiency of GDP per capita as a development indicator has been the subject of past research (Cobb, Halstead, & Rowe,1995; Vaury, 2003). Therefore, alternative social or health indicators are needed to complement or replace GDP per capita as a development indicator at China's sub-provincial level.

1.2 Research Objective: An Approach to Measuring China's Regional Development

The objective of the present study is to address the research problem, as stated above, in confirming, at the first stage, earlier critique of the HDI to the effect that this indicator involves redundancy by way of including other existing indicators that measure development. At the second stage, this study will show that HDI is entirely unsuitable for sub-national analysis of development in China, such as comparative examination of regions or provinces. At the third stage, this study will propose a complementary measure to GDP per capita for comparative analysis of China at the sub-national level.

1.3 Research Outline

This thesis includes nine chapters. Following this introduction, the second chapter is the review of the selective development indicators, with a focus on the advantages and disadvantages of HDI. The third chapter lists the existing data structure of China's national and provincial HDI. Chapter four demonstrates problems using HDI as an indicator in China due to issues of comparability and redundancy. Chapter five briefly describes the use of the GDP per capita as the dominant indicator at China's prefectural level. Chapter six introduces the geographic and administrative structure of Liaoning province as a case study of the present research. Chapter seven presents the result of applying life expectancy as a development indicator in Liaoning Province. Chapter eight discusses the advantages of using life expectancy at Liaoning's prefectural level as a complement development indicator to GDP per capita when HDI is not available. Chapter nine concludes that life expectancy is an efficient development indicator for measuring level of human development at the sub-provincial level in China, and discusses also future policy implications of the present research.

CHAPTER 2
DEVELOPMENT INDICATORS: REVIEW OF LITERATURE

As mentioned earlier in the Introduction, over the years the concept of development has evolved. In order to measure and compare development among countries and regions, many indicators have been used by various levels of governments and organizations. For instance, some of the key development indicators that have been used by the World Bank include Gross National Income, GDP per capita, life expectancy, adult literacy rate and poverty rate. The WHO has been using indicators such as infant mortality rate, maternal mortality ratio, number of physicians and density, prevalence of HIV among adults, and population using improved drinking-water sources to assess countries' level of development. The UNDP has promoted a series of human development indicators such as the HDI, for the purpose of development measurement and comparison. Various levels of governments and international organizations use development indicators "for development analysis, for general diagnosis of development conditions and needs, and for general evaluation of progress" (McGranahan, 1972).

2.1 Objective Indicators

In order to address the entire methodological context of development indicators, it is useful to categorize them first. Development indicators can be classified into simple indicators and composite indicators (Schweinfest, 2001), or subjective indicators and objective indicators (Diener & Suh, 1997; Haq, 2009).

Objective indicators are quantitative measures. They are usually single numbers, used for a development policy making context (Schweinfest, 2001). They can be divided into simple or composite indicators. Simple indicators are further subdivided into Economic, Social and Health indicators. Composite indicators can be further subdivided into Sustainable Development indicators and Human Development indicators.

2.1.1 Simple Indicators

Simple indicators are development indicators that contain only one variable. Simple indicators can be economic, social, demographic, and environmental or constitute any index that measures development in a single dimension only. The biggest advantage of simple indicators is their simplicity since they are easy to compute, analyze and compare.

2.1.1.1 Economic Indicators

2.1.1.1.1 Gross Domestic Product (GDP)

For decades, the most commonly used development indicator for cross-national comparison has been the GDP. GDP is the total output of goods and services for final use produced by an economy within a given period of time, by both residents and non-residents, regardless of the allocation to domestic and foreign claim (UNDP, 2002). The conventional formula to calculate GDP is:

$$GDP = C + I + G + (X-M)$$

Where C is consumption, I is gross investment, G is government spending, X is export, and M is import.

GDP was first introduced as a monetary measure of wartime production capacity during World War II. It was believed that economic development would bring poverty to an end, and thereby further improve health and education of the population. The IMF and the World Bank have been using GDP as a primary measure of economic progress for years to rank countries and determine the funding of the projects around the world (Costanza, Hart, Posner, & Talberth, 2009). Per capita GDP, which is the total GDP divided by the total number of people in the country or region, is often seen as a representation of quality of life.

GDP has many advantages such as simplicity and universality (Schepelmann, Goossens, & Makipaa, 2010). But, economists have pointed out that GDP has many deficiencies as a development indicator (Castro & Farmer, 2004; Cobb, Halstead, & Rowe, 1996). First, GDP is just the sum of economic activities. It measures the flow of goods and services of an economy, not quality of life (Costanza, et al., 2009). Second, GDP cannot distinguish between good and bad economic activities. It counts social problems such as crime and divorce as economic gains (Cobb, et al., 1996). For example, GDP will increase if many people get sick and spend a large amount of money on medical treatments. This increase of GDP does not involve any development at all. Third, GDP hides disparities and inequalities within countries and regions. GDP might rise even along with an increase in the percentage of people living in poverty if severe inequality exists within the society (Castro & Farmer, 2004). Fourth, GDP ignores the environmental costs of economic activities since it does not consider the deductions of depreciation of physical capital or depletion and degradation of natural resources (UNDP, 2002 and 2006). As a result, it might cost the government much more to restore the environmental damage such as air and water pollution in the long run. Setting aside its deficiencies and critiques, GDP per capita is still one of the most often used development indicators today.

2.1.1.1.2 Income per capita

Per capita income is the total of all individual incomes in the country within a given period of time, normally one year, divided equally among the individuals. Accordingly, it is often used as a measure of development to rank countries and regions as a proxy of well-being. For example, the World Bank classifies economies based on GNI per capita. According to 2010 classification, countries with GNI per capita lower than US$1,005 are considered as low-income;

between US$1,006 and US$3,975 are lower middle income; between US$3,976 and US$ 12,275 are upper middle income; and above US$12,276 are high income (World Bank, 2011).

It is undeniable that rising income is likely to improve physical standard of living such as nutrition intake and housing conditions. However, per capita income has been referred to as a poor development indicator (Osberg & Sharpe, 2002). Just like GDP, per capita income does not give an indication of the distribution of income within a country or a region. A small wealthy group can drive up the per capita income for the community without any improvement on the majority of people's life. According to a survey by China's NBS, less than five percent of China's wealthiest hold nearly a half of the country's savings deposits worth more than 6 trillion Chinese Yuan (Wallace, 2005). Thus, per capita income is not a proper development indicator, especially for countries with great inequality.

Another disadvantage of using economic indicators such as income per capita to compare countries is the involvement of currency exchange rate, purchasing power and the selection of goods and services for comparison. Based on this concern, PPP has been used internationally to adjust the real value of GDP and income per capita. PPP is "the number of currency units required to purchase an amount of goods and services equivalent to what can be bought with one unit of currency of the base country"(World Bank, 2007). Similar goods and services have different prices in different countries and regions. Exchange rates can only reflect the value of goods or services in different currency, but not the differences in price levels. The simplest way to calculate PPP between two countries is to compare the price of one identical good or service. For example, the *Economist* magazine publishes its 'Hamburger Index' annually to compares the price of the McDonald's Big Mac hamburgers around the world. According to the *Economist*, in January 2004, an average Big Mac was $2.80 in the U.S., $1.23 in China, and $3.48 in the

European countries on a PPP standard. This indicated that Chinese Yuan was 56 percent undervalued; while euro was 24 percent overvalued against the US dollars (Taylor & Taylor, 2004).

PPP was initially developed in 1918 by Gustav Cassel as a theory of exchange rate determination based on the idea that price of an identical good in two different countries would be the same, under ideal conditions, after adjusting the rate of exchange. In recent years, the PPP has been used to reflect price differences of goods and compare the living standards across countries (Lafrance & Schembri, 2002). Due to geographical and cultural differences across countries and regions, however, it is difficult to find the appropriate basket of goods and services comparable across countries (Langston & Best, 2005).

2.1.1.1.3 Unemployment Rate

Unemployment rate is another economic indicator that has great influence on standard of living. Unemployment rate is the percentage of unemployed population that accounts for the total labour force. Unemployed refers to "all people above a specific age who are not in paid employment or self-employed, but who are available for work and have taken specific steps to seek paid employment or self-employment" (UNDP, 2010). Unemployment rate is a good reflection of local economy. Countries that have growing and stable economies have a relatively low unemployment rates compared to that of less economically advanced countries. But, lower unemployment rate does not necessarily equal better quality of life since people might work part-time or be self-employed, and not make enough money to cover their daily expenses. These people are not unemployed, but they are unable to make enough money to live a decent life. Additionally, even for countries that have similar unemployment rates, the quality of life for those who are unemployed might be quite different due to the dissimilar employment protection and social welfare (Blanchard & Portugal, 2001).

2.1.1.2 Social Indicators

As early as the 1970s, the concept and focus of development has slowly shifted from solely economy-focused to concerns on social services such as poverty reduction and provision of education and basic health care (Anand & Ravallion, 1993). Social indicators complement economic indicators greatly in regards to measuring social well-being and quality of life. Social indicators cover a variety of aspects of people's lives such as public safety, health, housing, leisure and recreation (Sheldon & Parke, 1975).

2.1.1.2.1 Adult Literacy Rate and Gross Enrolment Rate

It is well known that education is a powerful development tool for both individuals and countries. Educational data is used as a development indicator because the level of education is closely connected to quality of life such as employment, income, and health (Gerdtham & Johannesson, 2001). Examples of educational data are literacy rates, years of schooling, and enrolment ratio. Two of the prevailing indicators that have been long used by the United Nations are adult literacy rate and school enrolment rate.

Adult literacy rate is "the percentage of people aged 15 and older who can, with understanding, both read and write a short, simple statement related to their everyday life" (UNDP, 2006). Previous research has indicated that individuals with better education tend to receive higher salaries compared to those with less education (Gerdtham & Johannesson, 2001), and a nation with a better educated population have a higher chance to achieving economic growth and development (Kirsch, 2001; Lu, 2007).

Although literacy plays an important role in the process of development, it has many deficiencies preventing it from being used as a development indicator. The first problem is the vagueness of definition of literacy. Widely defined, individuals who can read and write to cope with their daily life are literate. But, scholars argue that literacy is not only about reading and writing; it is also about whether individuals have the necessary skills, knowledge, and strategies to use throughout their lives in various contexts for their life learning experience (Kirsch, 2001; Sticht, 2001). An individual could be considered either literate or illiterate depending on the application of a 'wide' or 'narrow' definition of literacy. Often countries and regions have their own perceptions of literacy based on their cultural backgrounds and languages. This limits the comparability of data between countries and among regions.

Second, as literacy statistics are self-reported data, the validity of which is questionable. According to the UNDP, the adult literacy rate in many developed countries such as Canada has reached 99 percent. Nevertheless, this result conflicts with the abilities-standardized performance tests conducted by the IALS through door-to-door surveys (Sticht, 2001). The IALS assessed selected Canadians on their prose, document, and quantitative literacy, and then categorized their literacy level from 1 to 5. Level 1 indicates poor literacy skills such as being unable to determine the correct dosage on a medicine bottle. Level 2 individuals can deal with simple, clear text but will be challenged to learn new job skills. Individuals at level 3 are viewed as having skills adequate to cope with the demands of today's society. Individuals at levels 4 and 5 have strong skills and can process complex and demanding information (OECD, 2005). Results revealed that 18.2 percent of adults (3.3 million) were assigned to level 1 with poor literacy skills on the document scale. Apparently, the self- reported literacy rate is significantly higher than the door-to-door survey.

Another educational-related measure is gross enrolment ratio which is "the number of students enrolled in a level of education, regardless of age, as a percentage of the population of official school age for that level" (UNDP, 2006). Developed countries such as Norway have a combined primary, secondary, and tertiary gross enrolment ratio as high as 98.6 percent, but the number was as low as 54.4 in less developed countries such as Zimbabwe (UNDP, 2010).

The problem with the gross enrolment ratio is that it can reach over 100 percent if there is a high grade repetition rate or mismatch of students' age and their grade level. Also, enrolment ratio only shows the percentage of children who attend school; it does not address the issue of quality of education. As early as 1975, Sheldon and Parke (1975) had made comments on the use of educational data. "For years we have had abundant data on school attendance, school years completed, teacher-pupil ratios, numbers of schoolrooms, and the bonded indebtedness of school districts, but who knew how much the children were learning?"

Scholars and international organizations have pointed out that educational data should be handled with caution since its definition and methodologies of data collection differ across countries and regions (World Bank, 2010). Complementary performance tests are needed in order to get more details, and enhance the validity and quality of the educational data.

2.1.1.2.2 Poverty Rate

Reducing and eliminating poverty is a common development goal for all nations around the world. Poverty has different forms, which include: the shortage of material needs such as food, shelter, and safe drinking water; lack of access to basic social services such as schools and clinics; and exclusion from "participation in decision-making and in civil, social and cultural life" (United Nations, 1995). Poverty can be defined as relative poverty or absolute poverty. Relative poverty means that household's income or consumption is below the average economic threshold according to specific standard. Absolute poverty is defined as a standard of living below an absolute benchmark in order to meet some basic needs of daily life (Zenteno & Bane, 2009). Poverty rate refers to the percentage of people who live below specific poverty level.

The World Bank is the primary data source on global poverty and collects its data based on household surveys conducted in various countries (Elvidge et al., 2009). The currently used international poverty lines are $1.25 a day for low-income countries and $2 a day for middle-income countries at 2005 PPP price. The distinct amounts have attempted to account for differences in PPP, as of 2005, and such differences will naturally vary over time and over geography. Poverty nowadays is mainly concentrated in Sub-Saharan Africa, South Asia, and part of East Asia and the Pacific. Although poverty has declined significantly throughout the world, the number of people who are at risk of falling into poverty has increased over the years due to climate change, natural disasters, and political and military turmoil (World Bank, 2010).

Poverty rate is a key indicator in measuring quality of life and level of development. But, like educational indicators, the poverty rate is greatly affected by cultural and geographical differences as well. First, people with different social background and cultural background might have different conceptions of poverty. Second, discrepancy of price level and purchasing power makes it difficult to compare poverty rate between nations. Third, the poverty line needs to be adjusted frequently according to the economic conditions. Thus, in practice, many countries set up their own national poverty line based on their development conditions, cultural setting and the needs of the local people. In terms of policy making and comparability, the national poverty line works better than the international poverty line.

2.1.1.3 Health Indicators

Health indicators were promoted as the alternative to economic indicators as early as in the 1970s. First, health indicators are direct observations of living experience of people. Therefore, the use of health indicators matches the conception of putting human beings as the center of the development (Castro & Farmer, 2004; Justice, 1989). Second, it has been proven that economic growth does not necessarily improve health indicators; rather, good health is the prerequisite to promote socioeconomic development (Castro & Farmer, 2004; Song, 2000).

2.1.1.3.1 Infant Mortality Rate

Infant mortality rate is a frequently used health indicator. It refers to the number of infant deaths between birth and exactly one year of age per 1,000 live births (UNDP, 2003). Infant mortality rate is closely monitored in developing countries since it is a good reflector of overall health development. Infant mortality rate is very sensitive to socioeconomic conditions such as level of sanitation and the quality of medical care (Cornia, 2001; Song, 2000). Infant mortality rate for many developed countries is as low as 3, while in some poverty prevailing countries this number is over 150 due to food shortage, lack of medical care or political conflict (De Sherbinin, 2008).

Another related indicator is under-five mortality rate (probability per 1,000 that a newborn baby will die before reaching age five, if subject to current age-specific mortality rates) and maternal mortality rate (number of women who die from pregnancy-related causes during pregnancy and childbirth per 100,000 live births) (World Bank, 2010).

2.1.1.3.2 Life Tables and Life Expectancy

Life expectancy at birth is the number of years a newborn infant would live if prevailing patterns of age-specific mortality rates at the time of birth were to stay the same throughout the child's life (UNDP, 2002). Life expectancy has been long used as an indicator to assess the level of economic development and the quality of medical care (Bradshaw & Smith, 2006; Song, 2000). According to the WHO (UN, 2000), countries with life expectancy above 70 years old are seen as long-life countries and the current average life expectancy for developed countries and developing countries is 75 years and 63 years respectively.

Life expectancy estimates are derived from life tables. Life tables statistically summarize the death rate for a given period of time. The first life tables were developed by an English demographer named John Graunt (1620-1674) and later published by Williams Farr in 1843. Since then, life tables have been widely accepted and used as a major tool to calculate life expectancy.

Life tables can be categorized as generation or cohort life tables and current life tables (Ficenec, 2003). The generation or cohort life table tracks the mortality experience of a group or cohort of individuals that were born in the same period of time until no life remains in the group. But this method is rarely used because it is difficult to collect data over such a long time. The current life table is the most commonly used method. It applies the current age-specific mortality of an actual population to a hypothetical cohort group assuming that the prevailing mortality rate will remain unchanged into the future until all members of the cohort have died (United Nations, 2000). The life tables are generally constructed with a hypothetical population of 100,000 people and up to the age of 100 years old (Bomsdorf, 2004).

The life table can also be classified into complete life table and abridged life table based on the age intervals used. Complete life tables are constructed based on single year age interval, while abridged life tables normally use a 5-year age interval. Complete life tables are often used for national population analysis and abridged life tables are more suitable for smaller population such as at sub-national and sub-provincial levels (Flowers, 2003).

In order to use life table to compute life expectancy, population census data are often used. Flowers (2003) noted that life expectancy at birth is a useful global or summary health measure. Also, as an indicator, life expectancy has many great characteristics “purposeful, valid, possible to construct, comparable, timely.”

2.1.2 Composite Indicators

Composite indicators were built on the belief that single indicators are not able to capture the complexity and multi-faceted aspects of development. A composite indicator is a mathematical aggregation of a set of simple indicators or sub-indicators, integrating many development features such as economic, political, educational, environmental, and health parameters into a single index. Ideally, composite indicators are more complete than simple indicators in terms of development measurement because of their multi-dimensional structure. A large body of literature, however, had heavily criticized composite indicators on account of data aggregation techniques and determination of the weights for composing simple indicators (Booysen, 2002; Zhou, Ang, & Zhou, 2010) since the application of different weighting system and selection of sub-indicators can lead to altered results.

Despites past critiques, many composite indicators have been created and introduced over the years. The most prevailing composite indicators are Sustainable Development Indicators and Human Development Indicators.

2.1.2.1 Sustainable Development Indicators

The concept of sustainable development was proposed based on the concern that economically focused development has ignored the negative human impacts on the natural environment; our ecological systems of the planet are suffering serious and irreversible damage, and therefore, environmental protection is urgently needed in order to reserve natural resources for the future generations (Ng, 2008; Siche, Agostinho, Ortega, & Romeiro, 2008). Two of the most important contributions to the development of sustainability indicators are EF and ESI (Siche, et al., 2008).

2.1.2.1.1 Ecological Footprint (EF)

The EF is a resource accounting tool which measures "how much biologically productive area (whether land or water) a population would require to produce on a sustainable basis the renewable resources it consumes, and to absorb the waste it generates, using prevailing technology" (Schaefer, Luksch, Steinbach, Cabeca, & Hanauer, 2006).

The EF includes two major components. The first component is the land used for crops, pastures, forest products, and human build-ups to produce goods and services for human needs. The other component is the area that needed to absorb the carbon emissions from burning of the fossil fuels (Haberl, Erb, & Krausmann, 2001).

In order to assess whether a region or a country is in ecological debt or credit, the EF needs to be compared with its regional or national biocapacity (BC). BC is the total biologically productive area such as arable land, forest, productive sea available in a certain area (Schaefer, et al., 2006). EF represents the human demand on natural environment, and BC represents the available ecological supply. A country overuses its resources when its EF is greater than the BC. Inversely, renewable resources are reserved when its EF is smaller than the BC.

The concept of EF plays a key role in long-term development policy making and evaluation in terms of environmental protection and sustainability. The calculation of EF, however, can be difficult and complicated due to data availability and lack of reliable measuring techniques (Schepelmann, et al., 2010).

2.1.2.1.2 Environmental Sustainability Index (ESI)

The ESI was developed by a group of scholars from Yale University and Columbia University, and first presented in 2000 in World Economic Forum (Siche, et al., 2008). Over the years, ESI has gained its popularity. ESI is a multidimensional index, it covers 5 dimensions, contains 21 underlying indicators, and 76 variables (Esty, Levy, Srebotnjak, & De Sherbinin, 2005; Siche, et al., 2008). The five dimensions are environmental systems, reducing environmental stresses, reducing human vulnerability, social and institutional capacity, and global stewardship. Examples of indicators are air quality, water quality, and greenhouse gas emissions. Types of variables include freshwater per capita and carbon emissions per capita. Values of the ESI for each country vary between 0 (most unsustainable) and 100 (most sustainable). The higher a country's ESI score, the better positioned it is to maintain favourable environmental conditions into the future.

The merits of the EF and the ESI are their contributions to add the environmental aspect of development into development evaluation. But, as composite indicators, both of them require a large amount of data and complex calculations. Not all of the information is available, especially for less developed countries and regions. Even for the available data, the quality of data is questionable (Siche, et al., 2008). Although, EF and ESI have received growing academic attention and popularity, sustainable development indicators have not been widely used presently (Mitchell, 1996). The lack of application of a clear and widely acceptable method limits the reliability and satisfaction of using the sustainable development indicators. Last, geographical diversity and cultural difference might demand a different set of indicators for the evaluation of sustainable development.

2.1.2.2 UNDP Human Development Indicators

The concept of human development was proposed based on the belief that the notion of development is beyond the economic growth and other accumulation of wealth; individuals' capacities, choices and needs should be emphasized in the process of development (Sen, 1999). Human development stresses that development is about what individuals can actually do and be; underdevelopment refers to the lack of certain basic capability, rather than lack of income per se. This capability can be expanded through economic growth, poverty reduction and improvement of social services (Anand & Ravallion, 1993).

The UNDP published its first HDR in 1990, where human development concept was first introduced as "enlarging people's choices" and "creating an environment in which people can develop their full potential and lead productive, creative lives in accord with their needs and interest" (UNDP, 1990). Over the years, the UNDP has introduced five human development indicators in total. These indicators are HDI, HPI- 1, HPI- 2, GDI, and GEM (see Table 2.1). These indicators are constituted with various composing sub-indicators and cover different dimensions of human development.

2.1.2.2.1 Human Development Index (HDI)

Among all five UNDP's human development indicators, HDI is the most accepted and widely used indicator for national and sub-national development measurement and comparison. HDI combines three dimensions and four sub-indicators. The three dimensions are health, education, and standard of living. Four sub-indicators are life expectancy at birth, adult literacy rate, combined primary, secondary, and tertiary gross enrolment ratio, and PPP -adjusted real

GDP per capita in US dollars. According to the UNDP, people's choices change over time, but some of the aspects of development are the essentials of human development: "to live a long and healthy life, to acquire knowledge and have access to resources for a decent standard of living" (UNDP, 1990, p.10).

There are two major steps for the calculation of the HDI. Step 1 is to convert raw statistics data of life expectancy at birth, adult literacy rate, school enrolment ratio, and GDP per capita into sub-index. Step 2 is to aggregate the three sub-indicators into one index to get the average of the health, education, and standard of living.

$$HDI_i = \frac{1}{3}\sum_{j=1}^{3}\left(\frac{x_{ij} - \min F_{ij}}{\max F_j - \min F_j}\right) \qquad (1)$$

Where x_{ij} is the actual value of component j for county i (Noorbakhsh, 1998). Min F_j and Max F_j are the minimum and maximum values set up by the UNDP for each of the sub-indicators of the HDI. They are:

1) Life expectancy at birth (years): 25 years and 85 years
2) Adult literacy rate (%): 0% and 100%
3) Combined gross enrolment ratio (%): 0% and 100%
4) GDP per capita(PPP US$): $100 and $40,000

The overall HDI is an arithmetic value between 0 and 1. The higher the HDI value, the better human development it indicates. Countries can be classified into different categories according to their human development levels (UNDP, 2004). HDI above 0.9 represents very high human development; 0.800 to 0.899 indicates high human development; medium human development is from 0.500-0.799; and countries with value below 0.500 are considered as low human development.

As a composite indicator, HDI has some unavoidable deficiencies and received many critiques over the years. First, HDI assigns equal weights for all of its three dimensions. But, weights should reflect the relative importance of each of the variables and/or components (Drewnowski, 1974). HDI weighting is subjective and arbitrary (Chowdhury & Squire, 2006; Noorbakhsh, 1998). HDI value masks trade-offs among its three components (Sagar & Najam, 1998). It is impossible to tell if an increase in HDI is caused by boost of GDP or growth of life expectancy or improvement in education. Also, in the real world, each country has different development priorities and focus due to their development stages and the needs of the people. Suggestions have been made that different types of societies should employ different weighting systems (Booysen, 2002).

Second, empirical experiments have proved that the aggregate HDI value is very sensitive to its maximum and minimum values. The HDI results and ranking order vary when different maximum and minimum values were selected and applied (Noorbakhsh, 1998). For example, changing the maximum of life expectancy from 78 to 73 years old could raise 22 countries from low to medium human development (Kelley, 1991).

Third, Lai (1999 & 2003) stated that the HDI is calculated without considering the population weights of each country. Improvement in life expectancy at birth for the whole population in China or India has a greater impact on the world development than that in Gambia or New Zealand because of the size of the population. It is more difficult for a country with a large population to improve life expectancy than for one with a smaller population.

Fourth, HDI is criticized for its redundancy. Scholars pointed out that HDI does not make a real contribution to the study of development indicators (Booysen, 2002). It is the aggregate of existing indices; it is an index of another index (Akkerman & Zhao, in progress). A common index is a measure of part of observed reality. Thus, years of living, level of education, and the amount of income and physical materials available are all common indices. In contradistinction with common indices, HDI does not measure the observed reality, but it measures only other indices. Specifically, a value of HDI does not reflect a direct observation of any sort of quality of life. HDI is, therefore, incapable to offer useful information to the general public who are not familiar with the term 'HDI'. Additionally, the three components of the HDI are highly correlated (Stapleton & Garrod, 2007). Higher economic indicator promotes better education opportunities and longer life; healthy and educated population promotes economic development as well. Therefore, HDI reveals nothing new that per capita GDP and life expectancy would not disclose (Ogwang, 1994).

Fifth, HDI has been blamed for its ignorance of inequality (Sagar & Najam, 1998). HDI estimates the average level of human development for a country without the ability to express development discrepancies and gaps within the country. HDI could offer a distorted development picture and hide serious inequality existing in a country.

Sixth, as a development indicator, the biggest problem of the HDI is its lack of comparability over a period of time due to its modification in methodology and changes on the maximum and minimum values for its sub-indicators (Anand & Sen, 2000; Booysen, 2002; Saha, 2009). HDI's comparability is also questioned by scholars on the quality of data that were collected and used to construct the indicator. Lind (2004) stated that HDI's underlying statistics are uncertain and sometimes data are estimated instead of directed observations.

Seventh, HDI is criticized for ignoring other important aspects of human development, namely, environmental impact and political rights (Kelley, 1991; Sagar & Najam, 1998). Over the years, many countries have gained economic growth with the sacrifice of their natural environment and capital resources; others have made great progress on physical living conditions and material success, but little improvement on status of women, political liberties and freedom of speech.

Although HDI has many deficiencies and is still an evolving indicator, it has gained its popularity over the years. The annually published UNDP HDI has been commonly accepted and broadly used by various levels of governments and organizations for development assessment and regional comparison (Yang & Hu, 2008).

2.1.2.2.2 Other UNDP Human Development Indices

As a response to critiques of the HDI, the UNDP has created four other Human Development Indicators as the complement of the HDI. HPI was introduced by the UNDP in its 1997 HDR as a composite index measuring deprivations in the three basic dimensions captured in the HDI: a short life, lack of basic education and lack of access to public and private resources (UNDP, 1997). HPI is divided into HPI-1 for measurement of developing countries and HPI-2 for measurement of selected member of Organization for OECD countries.

GDI measures achievement in the same basic capabilities as the HDI, but takes note of inequalities in achievement between women and men. It includes health dimensions measured by female and male life expectancy at birth, education dimensions measured by female and male adult literacy rate and gross enrolment ratio, and standard of living measured by female and male estimated earned income.

GEM is a composite index that examines whether women and men are able to actively participate in economic and political life and take part in decision-making. It measures gender inequality in three dimensions of empowerment (UNDP, 2002). Examples of GEM sub-indicators are female and male shares of parliamentary seats, positions as legislators, and female and male estimated earned income (PPP US$). Although UNDP is able to identify disparities between women and men by using the human development indicators GDI and GEM, there are yet other inequalities such as those between various classes, ethnics, and social groups that still remained unaccounted for.

2.2 Subjective Indicators: Subjective Well-being or Happiness

Along with the progress of objective indicators' research, studies on subjective indicators have grown fast in recent years. According to Kahneman and Krueger (2006), while there were very few papers written in regards to subjective indicators in the early 1990s, there were more than 100 papers written on the same subject between 2001 and 2005. Unlike objective indicators based on quantitative and statistics data, subjective indicators focus on individuals' perception of quality of life such as satisfaction and happiness. Subjective data rely on self report through surveys or interviews. Common questions could be: "From scale 1 to 10, how satisfied are you with your life?" or "Taking your life as a whole, would you consider yourself very happy, somewhat happy, or not happy at all (Kenny, 2004)?" In the field of psychology, happiness is a narrower concept than subjective wellbeing, but economists use happiness and life satisfaction as interchangeable terms to measure subjective wellbeing (Easterlin, 2004).

Scholars who promote subjective wellbeing believe that happiness and satisfaction with life should be the ultimate goal of development (Ng, 2008). Happiness is defined as "the degree to which an individual judges the overall quality of his life-as-a-whole" (Schimmel, 2009).

Happiness is determined by both external and internal factors. External factors refer to living conditions; examples of internal factors are self-confidence, extraversion, and ambition (Schimmel, 2009). Subjective indicators were introduced based on the belief that economic indicators such as GDP do not reflect true quality of life. For example, Japanese real income increased fivefold between 1958 and 1987, but people's happiness level did not increase at all (Easterlin, 1995). China experienced high rate of economic growth between 1994 and 2005. But according to a study of 15,000 people, the percentage of people who are satisfied with their life has decreased and people who are dissatisfied with their life has increased over years (Kahneman & Krueger, 2006). GDP growth does not directly lead to increase of happiness, satisfaction, or quality of life since subjective wellbeing is strongly related to non-economic factors such as human rights, and societal equality (Diener & Suh, 1997).

Furthermore, economic development does not necessarily bring happiness into individual's life. High HDI does not constitute happiness in individuals or in the community at large. Many people's subjective perception of well-being, or happiness, is different from the UNDP's vision (Schimmel, 2009). HDI can only show the potential to be happy rather than reflecting the actual happiness (Gasper, 2004).

Scholars suggested that subjective indicators can complement, supplement or even replace economic indicators such as GDP since they offer qualitative information relevant to governmental policy making. In comparison, objective indicators are not able to provide such a valuable qualitative feature (Conceição & Bandura, 2008; Kahneman & Krueger, 2006).

However, happiness has many intrinsic deficiencies as a tool for development comparisons. First, since subjective data is based on self-report, its validity and reliability has been questioned based on the view that self-reporting are imprecise and vulnerable to distortion

(Veenhoven, 2004). The interviewers' style of wording might mislead the interviewees and cause distortion in the final results. Also, people with similar income and living conditions might have quite different degrees of satisfaction due to their social backgrounds, preferences, values, and other personal attributes. Personal experiences have great impacts on the subjective studies. Therefore, the reliability of subjective indicators is considerably lower than objective indicators (Conceição & Bandura, 2008). Second, it is questionable whether happiness is comparable over time or across geographical borders (Ng, 2008). Since individuals' emotion and mood fluctuate constantly, a person can be very satisfied with his or her life at one moment, but feel unhappy the next moment due to some dramatic life events. Thus, it is hard to compare happiness over time. Geographically, people have different concepts of happiness in different countries, regions and cultures (Pittau, et al., 2010). For a child who lives in a prosperous metropolitan region, getting a new laptop brings him or her 'happiness'; for a child who lives in a poor rural village in Asia or Africa, having abundant food and clean water means 'happiness'. Third, critiques state that happiness is a Western ideology (Schimmel, 2009). Most of happiness studies so far have been conducted in developed countries. For many developing countries, studies on subjective wellbeing are relatively new, and information on subjective well-being is severely deficient (Veenhoven, 2004). This increases difficulty for cross-national or cross regional comparisons. Therefore, scholars suggest that happiness should be combined with objective indicators in order to increase its validity, reliability, and comparability (Conceição & Bandura, 2008).

Overall, both objective indicators and subjective indicators have their advantages and disadvantages. In contrast with subjective indicators, objective indicators are relatively reliable and comparable since they are constructed based on quantitative data and standard formulas. But, subjective indicators can offer more detailed and in-depth information at individuals' levels.

For objective indicators, simple indicators are easy to interpret and compare. Composite indicators tend to measure development in multiple dimensions, but are relatively laborious to construct and their methodology is still evolving. As a typical composite indicator, HDI has become one of the most prevalent and often used development indicators in recent years. The use of the HDI has extended from national comparison to sub-national development evaluation for some countries such as China. But the outstanding question still remained to be addressed is one relating to the previous discussion on the deficiencies of the HDI.

If countries such as China want to adopt the HDI as a sub-national indicator, further probing needs to be done in order to see whether HDI is comparable across regions and across time; whether HDI offers a more complete picture of development than its composing sub-indicators; whether data for the HDI calculation is available; and whether HDI can truly reflect the development condition in China and the needs of the Chinese people.

CHAPTER 3
CHINA'S NATIONAL & PROVINCIAL HDI DATA STRUCTURE

3.1 Administrative Structure of Mainland China

The administrative system of mainland China can be divided into four levels under the control of the central government. The first level is the 31 provincial administrative units which include 22 provinces (*sheng*), five autonomous regions (*zizhiqu*), four municipalities (*zhixiashi*) directly under the central government (see Table 3.1). For simplicity's sake, in this research, 'provinces' refer to all of the first level 31 provincial administrative units which include provinces, autonomous regions and municipalities directly under the control of the central government. Until 1997 mainland China had just three municipalities, namely, Beijing, Shanghai, and Tianjin. In 1997, Chongqing, until then within the province of Sichuan, became a municipality directly under the control of central government. Data prior to 1997 only covers 30 provinces while after 1997 includes 31 provinces.

The second level of administrative division in China is the prefecture-level governments which include prefectures (*diqu*), prefecture-level cities (*dijishi*), autonomous minority districts (*zizhizhou*), and banners (*meng*) (Herrmann-Pillath, Kirchert, & Jiancheng, 2002). The third level is the county-level governments which include counties (*xian*), county-level cities (*xianjishi*), autonomous minority counties (*shaoshu minzu zizhixian*) and city districts (*qu*) that have the status of county-level government. The fourth administrative level is township-level governments which include towns, townships and sub-district level administrative units (Zhang & Wu, 2006).

3.2 Population Structure of China

China is the most populous country in the world with 1.3 billion people as of 2000. The structure of China's population is unique compared to other developing countries. The traditional population pyramids of developing countries are triangular in shape with a high birth rate and high death rate. However, the population pyramid of China is "somewhat rectangular" (Kincannon, He, & West, 2005) with a low birth rate in recent years as an effect of governmental population control policy as shown in Figure 3.1.

China used to have very high fertility rate in the 1950s and 1960s in Mao's era. According to Mao's dogma, a large population would help China gain more military and political power. The total fertility rate in China was as high as 7.5 in 1963 (Poston and Duan, 2000). By the mid-to late 1970s, Chinese leaders realized that the large population and the high fertility rate could be an obstacle for China's future economic and social development. Therefore, the well-known 'one child' policy was introduced in 1979. The implementation of this policy has led to a sharp decrease in fertility rate as shown in Figure 3.1, cohort aged 20 to 24. By the early 1990s, China's total fertility rate has dropped below the replacement level of 2.1 (Poston and Duan, 2000). There are two obvious bulges shown in China's 2000 population age pyramid, the first bulge is the cohort aged 30-34 before the initiation of one child policy, and the second one is the cohort aged 10- 14 as the children of the generation of the cohort 30-34. Between 1949 and 2000, China's population structure has changed dramatically. Along with the decreasing fertility rate, China's population is aging fast. Recent population projection has shown that China will have a larger percentage of older population (65 and over) than younger population (0 to 19) by 2050 (U.S Census Bureau, 2010).

3.3 National Level HDI Data

In the present research, China's national HDI values were obtained from the UNDP's HDRs, 1990-2010. Until recently, the published HDI has lagged some 2-3 years behind the HDR due to the delay of data collection and processing. For instance, the 2009 HDR reported

HDI value from 2007. Only the latest HDR, for 2010, has reported HDI values for the year of 2010. China's national HDI values are not available for the year of 1991, 1996, 2008 and 2009.

UNDP does not collect original data for the calculation of the HDI. Rather it obtains data from credible international data agencies, such as the United Nations and the World Bank. In the view of UNDP, data collected by international agencies are of better comparability than data collected by statistical agencies of individual countries (UNDP, 2009). The UNDP lists data sources in their corresponding tables and bibliography. Let us take 2009 HDR for example, the UNDP obtained data of life expectancy at birth from *World Population Prospects 1950-2010: The 2008 Revision* prepared by the United Nations Department of Economic and Social Affairs Population Division. Data for both adult literacy rate and combined gross enrolment ratios in primary, secondary and tertiary education were taken from the UNESCO Institute for Statistics. GDP per capita (PPP US$) data were obtained from the World Bank's World Development Indicators database. The annual Human Development Report, 1990-2010 and corresponding HDI data are accessible online at UNDP's website (UNDP, 2010).

3.4 Provincial Level HDI Data

HDI values for China's provinces used in the present study were obtained from the six CHDRs published by the UNDP in collaboration with other international institutes or Chinese organizations. They are 1997, 1999, 2002, 2005, 2007/08 and 2009/10 CHDRs. The year of the CHDR does not always correspond with the HDI values. For example, the 1997 CHDR published HDI for both 1990 and 1995, the 1999-2009/10 CHDRs reported HDI for the year of 1997, 1999, 2003, 2006, and 2008 respectively. Each of the CHDRs has had a special theme focusing on a specific issue related to China's development. The CHDR in 1997 emphasized poverty alleviation; in 1999 it stressed the role of state efficiency in market economy; in the years 2002 and 2009/10 the CHDR discussed environmental concerns, particularly sustainable development; and the 2005 and 2007/08 Reports focused on social equity, specifically, equal access to basic public services such as social security and health care (see Table 3.2).

CHAPTER 4
CHALLENGES IN THE USE OF THE HDI IN CHINA

China has a vast territory with a variety of geographic features and climate zones. The level of social and economic conditions is significantly different within the nation. Great development disparities exist between the coastal and interior regions, and between the urban and rural areas. As a national average, the value of China's HDI alone can be misleading since it hides the great disparities within the country. In addition, the UNDP has made a few major changes on the methodology and components of the HDI. This has caused the problem that HDI values published in various reports are not comparable. Finally, the previous HDRs have shown that the ranking of China based on GDP per capita and HDI is identical. Identical ranking, furthermore, can also be detected in the comparison of GDP per capita and HDI, and life expectancy and HDI across China's provinces, as explained in this chapter.

4.1 HDI as a Disguise of Inequality throughout China

The People's Republic of China was established in 1949 as a socialist system of planned economy. During Mao Zedong's rule (1949-1976), all of the means and materials were either state-owned or collectively owned (*jiti suoyouzhi*) (Guo, 2003). In urban areas, the state-owned enterprises provided social benefits for their workers such as housing, education and health care. In the rural regions, communes offered some basic social services and securities. Chinese communes were comprised of production teams and brigades. A commune included average 15 brigades; a brigade consisted of average 7 teams; a team contained average 34 households. Communes were "the lowest unit of local government", responsible for finance, tax, agricultural production, construction of the community, education and health, civil administration, and keeping public orders for its commune members (Chinn, 1978). Although, the standard of living and level of income was very low prior to the economic reforms of 1978, wealth was relatively evenly distributed and majority of households had a similar level of quality of life.

The important turning point for China's development was the economic reform promoted by Deng Xiaoping in 1978. The reform boosted China's economy by opening the Chinese market to the world, attracting foreign investment and importing technologies from other countries. Since then, China's economy has rapidly transferred from a planned economy to a market economy with Chinese characteristics.

China's economic reforms and market economy replaced the egalitarian socialist structure with sharp socioeconomic stratification. China's fast economic growth has led to an imbalanced development with great regional discrepancies across provinces and between the urban and rural areas (Yang and Hu, 2007; Zhang and Kanbur, 2005). China's Gini coefficient (a measure of inequality ranges from 0 to 1. 0 represents absolute equality; 1 indicates complete inequality) has been continuously growing over the years, from 0.3 in 1982 (UNDP China, 2005) to 0.47 in 2010 (Chen, 2010), which is among the world's most unequal countries. The great economic disparity has also affected other areas of social development of the country.

4.1.1 Disparities of Development: Urban vs. Rural China

A large body of literature has described the severe development disparities between China's urban and rural areas (Li & Dorsten, 2010; Sicular, Ximing, Gustafsson, & Shi, 2007; Sutherland & Yao, 2011). The development disparities exist in economic, educational, health care and many other aspects of life. However, as an arithmetic average value (for the HDRs 1990-2009), HDI hides the urban-rural disparities within China.

For instance, China's average urban HDI in 2003 was 0.816, which was similar to Cuba and Mexico among the 57 high human development countries. In contrast, China's average rural

HDI was only 0.685, which was similar to the level of Bolivia and Mongolia ranking only 114 among the 177 listed countries. China's overall HDI was 0.755 in 2003, which was classified as medium human development (UNDP, 2005). The single number of China's national HDI disguised the urban-rural development inequalities.

So far, the CHDR from 2005 was the only report that recorded urban HDI and rural HDI separately across China's provinces. The rest of the CHDRs have reported the HDIs for provinces without the urban-rural split. China's urban-rural disparities have existed for a long time, caused by biased development policies, limited governmental spending in rural areas and China's restricted household registration system.

4.1.1.1 Urban Favoured Development Policies

Since the establishment of People's Republic of China in 1949, development policies have been often criticised as biased in favour of urban against rural areas (Lin, Cai, &Li, 1996; Zhang & Kanbur, 2005). During 1950-1970, the central government set industrialization and modernization as national development goals aiming to eliminate poverty and improve people's quality of life. Substantial investment was put into the expansion of state-owned enterprises in urban areas to build a heavy industrial base. As a result, there was a very low unemployment rate in the urban areas since most of the urban citizens were hired by state-owned enterprises.

Compared to the urban areas, rural regions have been often disadvantaged. Under the strictly-controlled planned economy, peasants had no right to decide on what to produce and whom to sell to since all means of production and the final products were under the control of the central government, albeit usually through the intercession of collective communes. In order to stabilize the labour in the urban areas and ensure the process of industrialization and modernization, the central government collected various agricultural products with low prices and redistributed them to the urban workers. Compared to urban areas, the rural regions received little investment on its infrastructures and other social support (Wallis, 2008).

The urban-rural gap has further increased after the economic reform which started in 1978. The biggest urban-rural gap is income differential. The ratio of urban-rural disposable income per capita has increased from 2.69:1 in 1988 to 3.08:1 in 1995 and 3.13:1 in 2002 (Knight, 2008). By 2007, China had one of the highest urban-rural income ratio in the world (Sicular, et al., 2007). While most of the economic growths and job opportunities were focused in urban areas, there are still 26 million rural populations living in poverty according to the international standard of $1 per day (UNDP, 2005).

China's urban-rural gap becomes even larger if social factors such as education, health and unemployment protections are taken into account. For example, China's illiterate population are mainly distributed in rural areas. Urban residents receive much better education than their rural counterparts since the public education resources and teachers are concentrated in the urban areas.

Additionally, with the spread of agricultural machinery and the household contract responsibility system, the surplus rural labour cannot find employment opportunities. As a result, a large number of the rural population moves into the urban areas looking for employment opportunities. Rural residents who live in urban areas do not enjoy the same social benefits as their urban counterparts because they do not have urban household registration and entitlement.

4.1.1.2 Restricted Household Registration (*hukou*) System

In order to control population mobility and resource distribution, Chinese central government enforced '*hukou*'[1] household registration system in the late 1950s. According to the *hukou* system, all Chinese citizens are categorized into two types of households: agricultural households (*nongye hukou*) and non-agricultural households (*chengzhen hukou*). Residents with agricultural households were supposed to reside in rural areas; only non-agricultural households were permitted to live in urban areas. The *hukou* system created social stratification and put rural residents into a disadvantaged position. Urban dwellers are entitled much more social welfare such as health care, education, old-age pension, and subsidized housing offered by the state-owned enterprises and state institutions (Wallis, 2008). Rural dwellers on the other hand had no access to such benefits. Accordingly, China's *hukou* system is one of the major causes of the rural-urban inequality today.

The urban-rural disparity is only one dimension of China's unequal development; the inequality is also seen as the imbalanced development between the coastal provinces and the interior provinces.

4.1.2 Disparities of Development: China's Coastal vs. Interior Provinces

Not all regions in China have benefited the same from the fast economic growth and social transformation. China's Eastern Coastal regions and part of the Central and Southern Regions have benefited the most from the economic reform. Compared to the coastal provinces, the Western inland provinces such as Gansu, Qinghai, Yunan and Guizhou are far less developed. The HDI of the coastal provinces is much higher than that of Western provinces (Lai, 2003). For instance, Shanghai's HDI was 0.917 in 2006, which was comparable to that of some countries

[1] *Hukou* is a household record of individuals' registration and is usually passed from one generation to the next (Fan, 2001).

like Kuwait and Cyprus, with a ranking of 31 among UN member countries. But the HDI of Guizhou Province was only 0.659, which was similar to Sao Tome and Principe and Bhutan with a ranking of 131 among 182 countries (UNDP, 2007/08 and 2009). The life expectancy difference between Shanghai and Guizhou province was larger than 10 years. The combined school enrolment in Shanghai was as high as 88%, while the number was lower than 60% for Guizhou province. The GDP per capita of Shanghai was 10 times of that in Guizhou Province (UNDP, 2007/08).

This unequal regional development is caused by several reasons. First, the initial economic development policies were focused and in favour of the Eastern Coastal regions, with the expectation that the development of the Coastal Region would extend to other provinces in China. Unfortunately, this hopeful scenario never materialized. Instead, the early development policies have created great regional development disparities over the years. Second, the withdrawal of the central government from being the provider of the various social services has increased the burden on the provincial and sub-provincial governments. As a result, local governments with sufficient revenues have been able to promote development projects, build infrastructure to attract investment and improve social facilities such as schools and hospitals for local communities. Conversely, local governments of poor provinces and regions have no budget that allows them to advance the local economic and social development. The localization of the social services and decentralization of the administrative authority has led to a situation where the rich regions become richer, and the poor regions remain poor or even become poorer.

According to the UNDP, China's HDI has steadily increased over the years. However, the development gap between China's urban and rural areas and coastal and inland regions has been widened as well. The annually published national HDI is too crude to represent the real development conditions in China. HDI needs to be disaggregated into smaller scales, namely, prefecture-level cities, towns, and counties in order to reflect development distribution and development gap.

4.2 Comparability Issues

The second challenge of using HDI in China is that both the national HDI values obtained from the HDRs are not comparable over the years. There have been two main problems linked to comparability of HDI. The first problem has been frequent changes in its methodology, which has forced UNDP, as the HDR authors, to retrospectively recalculate HDI values prior to the current HDR. The second problem is that HDI components have been changing over the years. Of the four variables composing the HDI, only life expectancy has not been changed up to 2010.

4.2.1 Problem in Methodology Changes

Over the observation period of 1990-2010, for which HDI values have been calculated and published, the UNDP has acknowledged that the HDI values are not comparable due to ongoing changes in methodology and changes in composing variables:

> "Statistics presented in different editions of the Report may not be comparable, due to revisions to data or changes in methodology…. Similarly, HDI values and ranks are not comparable across editions of the Report" (UNDP, 2007/08, p.222).

UNDP has attempted to partially ameliorate this deficiency by recalculating backwards values of past HDI, but this recalculating procedure has been occurring on an ongoing basis, thus instilling a great deal of doubt in the published values of the HDI (Ram, 2009; Srinivasan, 1994).

Below is a more detailed explanation of the problem of comparability of the HDI. In order to show trends in human development over past years, each year the UNDP recalculates HDIs retrospectively in its official HDRs based on methodology introduced in the current year's calculation of the HDI. The recalculation backtracks, sometimes to 1960, sometimes to 1980, and normally in 5-year intervals. For some years, therefore, more than one version of HDI values is available. In some cases the HDI values from different versions of the HDRs differ only slightly; but in other cases, the gap between various versions of the HDI values is very significant. China's national HDI values obtained from the HDRs 1990-2010 are all listed in Table 4.1. The HDI values obtained from various HDRs have been up and down for the year of 1975, 1980, 1985, 1990, 1995, 2000, and 2005. For example, in the 2002 HDR, the value for HDI in 2000 was 0.726; in the 2004 HDR the 2000 HDI value was changed to 0.721, in the 2006 HDR it was recalculated to 0.730, and subsequently to 0.719 in the 2009 HDR. Finally, in the most recent HDR for 2010, the 2000 value of HDI was recalculated to 0.636.

Figure 4.1 was made based on the selected values listed in Table 4.1, which were obtained from HDRs 2002, 2004, 2006, 2007/08, 2009, and 2010. The six HDRs recalculate China's national HDI values for the year of 1980, 1985, 1990, 1995, and 2000. Lines in Figure 4.1 show that HDI values did not deviate much between the HDR 2002, 2004, and 2006. The HDI values obtained from HDR 2007/08 were slightly higher than the values in the previous three HDRs, but the discrepancy is not significant. However, the HDI value obtained from HDR 2009 was significantly lower in comparison with HDI values calculated in previous HDRs. It is worth noting that the recalculated HDI values in HDR for 2010 are significantly lower in contrast to the HDI values recalculated in previous HDRs.

The differences between HDI values from various HDRs were caused by data revision and methodology changes of the HDI. The major HDI methodology changes the UNDP has made in the past are listed in Table 4.2. The methodology that has been used in the HDR 1990-2009 was similar, but with a few slight adjustments. The most significant methodology change was made in 2010 HDR, which has introduced the geometric mean to replace the long time used arithmetic mean (see section 2.2.2.2.1 formula (1) and Table 4.2) for the calculation of the HDI.

$$HDI = \sqrt[3]{I_{Life} \times I_{Education} \times I_{Income}} \qquad (2)$$

According to the UNDP, the geometric mean can better reflect uneven development than the arithmetic mean. The 2010 HDR was published at the late stage of the present research; therefore, this research is not going to discuss whether the geometric mean is more advantageous in terms of measuring development inequality compared to the arithmetic mean. The methodology changes, however, have greatly affected the comparability of the HDI over the years. The HDR has not instilled further confidence in its latest issue, even though it tried to reassure users that:

> "The HDI is comparable over time when it is calculated based on the same methodology and comparable trend data" (UNDP, 2010).

4.2.2 Changes in Components of the HDI

HDI values are not comparable over the years because of its methodology and component changes, in addition to the fluctuation of the maximum and minimum limits (see Table 4.2). HDI was first constructed with only three composing indicators in 1990. They were life expectancy at birth, adult literacy rate, and the real GDP per capita. For the HDR 1991 to 1994, mean years of schooling was added into the HDI as another educational variable. But it was substituted by the combined enrolment ratio in the 1995 HDR to 2009 HDR. The latest 2010 HDR has discarded the adult literacy rate that has been used since 1990, and the combined gross enrolment ratio that has been used for 15 years, and instead it brought back the parameters, mean years of schooling and expected years of schooling. According to the UNDP (2010), mean years of schooling was adopted because it is more accessible and can discriminate better among countries compared to adult literacy rate. The expected years of schooling was used because it offers extra information than combined enrolment rate; it is the years of schooling that a child can expect to receive given current enrolment rates.

In the economic dimension, GDP per capita has been used between 1990 and 2009 with some slight adjustments. But, the GDP per capita was replaced in the 2010 HDR by GNI per capita. According to the UNDP, GNI is a more accurate measure of a country's economic welfare (UNDP, 2010).

The maximum and minimum limits for each sub-indicator of the HDI have been changed a few times. In the early HDR from 1990 to 1995, there were no maximum and minimum limits for each component; the maximum and minimum limits fluctuated from year to year based on the actual development condition for countries with the best and worst performance. A set of fixed maximum and minimum values for the HDI components was introduced in 1994 HDR, with the 85 and 25 years for life expectancy at birth, 100 per cent and 0 per cent for the educational attainment, and $40,000 and $200 for the real GDP per capita. This set of values was adjusted slightly in the 1995 HDR, and the minimum value of the real GDP per capita was lowered to $100 due to the concern of the gender inequality. Since then, the fixed set of maximum and minimum limits had been continuously applied until 2009. The latest 2010 HDR has introduced new goalposts with the maximum and minimum value of 83.2 and 20 years of life expectancy at birth, 13.2 and 0 for mean years of schooling, 20.6 and 0 for expected years of schooling, and $108,211 and $163 for standard of living (see Table 4.2).

The components of the HDI and their maximum and minimum limits have been changed frequently in the past 20 HDRs. This has caused great changes on the values of the HDI. HDI values are not comparable over the years since the components of the HDI are not the same in the various HDRs.

4.3 Redundancy Issues

Besides the comparability issue, HDI also faces the problem that its composing indicators are highly correlated in the case of China. The UNDP has repeatedly emphasized that the HDI is a better development indicator than GDP per capita because countries with similar level of GDP per capita might have very different levels of human development. However, ranking countries by GDP per capita and by HDI has not shown significant ranking differences for China, Additionally, identical ranking is revealed in the comparison of HDI, GDP per capita, and life expectancy across China's provinces.

4.3.1 Ranking of HDI vs. GDP per capita internationally and across Provinces

One of the major arguments in favor of HDI is the UNDP claim that economic development does not necessarily lead to improvement in human development. Ranking countries by economic indicators and human indicators could be, therefore, significantly different. The case of China, however, stands against this argument. The ranking of the HDI and GDP per capita for China has not shown significant differences, as evident from Table 4.3.

For international comparison, significant ranking differences between Chinese HDI and its GNP per capita did appear for the HDRs 1990 - 1994, when the UNDP used GNP per capita, instead of GDP per capita to compare the ranking differences with the HDI. Starting from 1995, the UNDP, however, adopted GDP per capita to compare with the HDI, and the ranking differences have dropped sharply (around or below 10 among the over 160 UN member countries). In 2010 UNDP adopted GNI (an index virtually identical with GNP per capita) to replace the use of GDP per capita, and yet, the ranking difference has remained small (see Table 4.3).

For comparison across China's provinces, the ranking differences between the GDP per capita and HDI, for selected years within the period 1990 – 2008, are relatively small as well with only a few exceptions. Tables 4.4 - 4.10 ranked China's 31 provinces according to their HDI in descending order. In each table, Column 1 lists provinces' names, columns 2 and 3 show HDI values and corresponding ranks. GDP per capita and its ranking for provinces are listed in column 4 and 5, and the arithmetic difference between the ranks for GDP per capita and the HDI is shown in column 6. The same methodological approach has been used by UNDP in comparing GDP per capita and HDI for countries in the annual HDRs (UNDP, 1995-2010).

In Tables 4.4 – 4.10, ranking differences between GDP per capita and the HDI equal to or smaller than 5 are seen as no significant ranking differences; ranking differences larger than 5 are highlighted with grey color in column 6. The highest consistency in ranking between GDP per capita and the HDI is for the year 1997. None of the 30 provinces had ranking differences larger than 5. The second highest correspondence between provincial GDP per capita and the HDI is for the year of 1995 and 2008 where only 1 province (3%), namely Qinghai for 1995 and Hainan for 2008, had a significant ranking difference. The other 97% provinces remained identical ranking by GDP per capita and the HDI. For the year 2006, 2 out of 31 provinces (6%) had significant ranking differences, while the rest 94% provinces had ranking differences smaller than 5. The ranking for the year 2003 showed 3 out of 31 provinces (10%) had ranking differences larger than 5. This leaves 90% of the provinces remaining with a similar ranking. There were 4 out of 30 provinces in 1990 (13%), and 5 out of 31 provinces in 1999 (16%) with considerable ranking differences. The remaining 87% and 84% provinces respectively, either remained the same or had an identical ranking of GDP per capita and HDI.

The ranking comparison between the GDP per capita and HDI at both China's national level and provincial level did not show a significant difference. The result is consistent with McGillivray (1991)'s conclusion that HDI and GNP per capita are highly correlated with each other in terms of ranking. Using a simple statistical analysis to examine the composition and the usefulness of the HDI McGillivray concluded that the HDI "serves to provide an ideological statement rather than new insights into intercountry development levels".

4.3.2 HDI vs. Life Expectancy across China's Provinces

Using the same comparison methodology as in the measurement of ranking consistency between GDP per capita and the HDI in Tables 4.4 – 4.10, Tables 4.11 – 4.17 show that ranking China's provinces by life expectancy and HDI yields fairly similar results over the years.

The highest ranking consistency between life expectancy and HDI is for the year 1990. None of the 30 provinces in China had significant ranking differences. The ranking between life expectancy and the HDI for the years 2003 and 2006, shows 3 out of 31 provinces (10%) with ranking differences larger than 5. The other 90% of the provinces had the same ranking or differences smaller than 5. For the year 2008, 4 out of 31 provinces (13%) had ranking differences larger than 5, 87% provinces had identical ranking. The ranking between life expectancy and the HDI are relatively less consistent for the year of, 1995, 1997 and 1999, 6 out of 30 provinces (20%) in 1995, 7 out of 31 provinces (23%) in 1997, and 6 out of 31 provinces (19%) in 1999 had ranking differences larger than 5. This leaves 80%, 77% and 81% of the provinces respectively, remaining the same or having their life expectancy and HDI ranked identically.

The ranking between life expectancy and HDI for China's provinces did not show a definitely uniform pattern, but life-expectancy ranking has shown sufficient consistency with HDI ranking, to be used as a proxy in situations where HDI is unavailable.

Cahill (2005)'s research supports the above data, in that he criticized international ranking by HDI, by specifically pointing to the fact that component statistics of the HDI are highly correlated with each other. His conclusion was that HDI is a redundant indicator since most information conveyed by HDI is already captured in its composing indicators. For the purpose of ranking across China's provinces there is no compelling reason to use HDI values that are complicated and costly to attain. Rather, it is sufficient to use simple and easily available values of life-expectancy.

CHAPTER 5
MEASUREING DEVELOPMENT AT CHINA'S PREFECTURAL LEVEL

So far, existing studies on China's HDI have been mainly focused on the national and provincial levels. Nevertheless, it is necessary to disaggregate national and provincial areas under investigation into sub-provincial units in order to obtain a more accurate depiction of China's development. There is no HDI data available for sub-provincial administrative levels such as prefectures and counties. The dominant indicator currently in use for development comparison at a sub-provincial level in China has been GDP or GDP per capita (Chan, 2007).

As discussed in section 4.1, China's regional development disparities exist not only across provinces but also within, namely, between the urban and rural regions, among prefectures. Given earlier discussion (Section 2.1.1.1.1) regarding deficiencies of GDP in the measurement of development, it is appropriate to revisit the existing approach, represented by Takahashi (2006), particularly in an application at a sub-provincial level. Herrmann-Pillath et al (2002) has suggested that China's prefectures might be the "appropriate" administrative unit to use for regional development study and comparison. Unfortunately China's prefectural level data has been ignored by both Chinese and Western research on regional development in the past. China's provinces are too large, in terms of geographic scale and population size, as an administrative unit for research on regional disparities. For instance, the population of China's Henan province alone is three times of that of Canada. From this perspective, prefecture-level units have more advantages compared to provincial units since they could better reflect intra-provincial disparities. In addition, as an intermediate administrative unit, China's prefectures include both urban and rural areas with certain financial budget and development policy making power.

5.1 GDP per capita as an Indicator of Development

At present GDP per capita is the dominant development indicator to assess performance across prefectures in China. However, the quality and the reliability of the data has been questioned and criticized, by Katsuhide Takahashi (2006), in particular. Even the most developed countries in the world have no GDP per capita data available for small administrative areas due to technical and fiscal constrain. China's GDP per capita data, however, is available down to county level precisely because it is considered as a major performance assessment tool across China (Chan, 2007).

Prefecture-level cities in China calculate and announce their own GDP annually (Takahashi, 2006). GDP per capita reported over the years by local government have shown, however, persistent discrepancies with China's NBS reporting for identical geographical areas. A major reason for this has been the suspicion that GDP data at prefectural level is used in the ranking of the prefecture, while being also easily distorted by the local government and the local statistical office (Huang & Tong, 2009).

In addition, prefectures calculate GDP per capita based on *hukou* population instead of the actual population residing within the prefecture. Millions of migrant workers are excluded from the base population used for computation of GDP per capita, but their work is counted towards the overall GDP value of the prefecture. From this perspective, GDP and per capita data at prefectural level might be over-estimated (Chan, 2007).

5.2 HDI as an Indicator of Development at Sub-provincial level

Although the HDI is seen as "a powerful alternative to income as a summary measure of human well-being" (UNDP, 2005), studies utilizing HDI at China's prefectural level have been rare. Exception has been the study by Macpherson and Zheng (1996), who applied the UNDP methodology to 1990 data, in order to calculate HDI for the three prefecture-level cities, Shenzhen, Guangzhou, and Zhuhai, in China's Guangdong Province.

There are several reasons why HDI is not widely used as a development indicator at the prefecture-level in China. First, the relevant data for the calculation of the HDI is not always available for China's prefectures. Most of the economic, educational, and environmental data for China's sub-provincial areas, such as prefectures and counties, are not accessible for researchers or the general public (Banister & Zhang, 2005).

In addition, the cost of producing HDI at a small geographic level, increases significantly primarily because of the increasing number of subareas (Gampat & Sarangi, 2009). In 2001, there were 265 prefecture-level cities throughout China (Chung and Lam, 2004) and creating data set for such a large number of administrative units, not only requires financial resources, but also involves professional training in order to control the quality of the data. Although the suggestions have been made that HDI should be disaggregated into different administrative levels or for different social groups (de la Torre & Moreno, 2010), it would be an onerous task for any country in the world to build HDI data set for local municipalities.

At the same time, however, it is crucial for China's local governments at the prefecture-level to avail themselves of proper development indicators in order to reflect intra-provincial inequalities and make co-ordinate regional development policies. Given the preceding discussion, such indicators could hardly include the HDI or the GDP.

5.3 Life Expectancy as a Development Indicator

In the present research, life expectancy is recommended as an indicator for measuring development at China's prefecture-level when HDI is not available. Life expectancy for prefectures across China can be calculated based on Provincial Population Census data, and intercensal population estimates. Provincial population data can be disaggregated into administrative units as small as city, town, and county within each prefecture. Compared to the heavily criticized GDP data, the quality of mortality data obtained from China's population census has been seen as "quite high" (Banister & Hill, 2004).

As a composing indicator of the HDI, life expectancy is the only variable that has not been changed or replaced in the past 20 years in the HDR. In comparison, the economic and educational variables of the HDI have undergone major changes thus turning the subject to increasing criticism. In the most recent HDR, the UNDP stated that "there is no viable and better alternative to life expectancy at birth" as a measurement of health (UNDP, 2010). Lind (2010) even suggested that life expectancy should be given more weight in the calculation of the HDI.

The universal consensus has been that population health is the prerequisite of human development (Sen, 1998 and 2006), while good health is the prerequisite for individuals to implement their "capabilities, choices, and freedom" (Li & Dorsten, 2010). Life expectancy, accordingly, has been traditionally viewed as an indicator of health. Life expectancy, however, reflects not only the health of the population, but also its quality of life.

Life expectancy is a major indicator of social development. It is generally positively related to economic development and educational attainment. "It has long been suggested by researchers that health is one of the most valid indicators to evaluate a population's well-being and social stratification" (Li & Dorsten, 2010). As a key component of the HDI, life expectancy is positively correlated with the other two components as well. Economically prosperous population and better educated individuals tend to have longer life expectancy since better economic conditions lead to better nutrition and housing; more educated people generally have better access to information on how to live a healthy life (Banister & Zhang, 2005; Song, Gong, & Zheng, 2010).

The UNDP 1991 report states that disparity in life expectancy within countries is bounded because its upper limit cannot exceed levels such as 100 years, for example. In contrast, GDP has no theoretical upper limit, and GDP disparity can be thus significant across or within countries. As an indicator of wellbeing, life expectancy, therefore, is more evenly distributed across geographic space than GDP. Accordingly, life expectancy across a given prefecture, throughout China, can be assumed, as well, to be more evenly distributed than GDP per capita. For the purpose of comparison of prefecture-level development within a province, it would appear therefore, that life expectancy has a significant advantage over the GDP. Indeed, life expectancy has been used in development research on China, from the provincial level (Congdon, 2007) down to local communities (Li, Luo & Klerk, 2008). Putting aside the unavailability of HDI, a major advantage of life expectancy over the HDI is that life expectancy is comparable across time, among countries and regions, and population groups.

CHAPTER 6

LIFE EXPECTANCY AS A SUB-PROVINCIAL INDICATOR FOR CHINA'S LIAONING PROVINCE

For the purpose of examining life expectancy as a measure of development in China, Liaoning province has been chosen in the present research. The case study of Liaoning will allow examining life expectancy also in context of comparison of development between Liaoning's prefecture-level cities. As China's first and most important heavy industrial center in the period of 1952-1978, Liaoning was one of the richest and fastest growing regions with high concentration of national government investment in state-owned enterprises (Duncan & Tian, 1999).

Due to inefficient management and outdated equipment and technology in the large state-owned enterprises, in the competition of market economy following the 1978 economic reforms, Liaoning province has gradually lost its competitive advantage. As a result, millions of workers were laid off in the urban area of Liaoning province since the early 1990s. According to the CHDR (2002), the average annual urban household income per capita in Liaoning was among the lowest across China's provinces at the onset of the 21st century. In 2003, the Chinese central government proposed development policy of 'Revitalizing the Northeast' (*zhenxing dongbei*). Since then, Liaoning's economy has been slowly reviving, as a result of which, however, the provincial and local governments are now challenged with providing social benefits, health care and re-employment opportunities for the large number of laid-off workers.

6.1 Geographic Structure of Liaoning

Liaoning province is located in the south of Northeast China (118°53'- 125°46' E, 38°43'-43°26' N). Liaoning, along with Jilin and Heilongjiang province form China's Northeast region. Liaoning province borders the Yellow Sea and Bohai Gulf in its south, Yalu River in the southeast, Jilin Province to the northeast, Hebei province to the west, and Inner Mongolia to the northwest. The area of Liaoning province is 148, 000 square kilometers. Eastern Liaoning is a mountainous region with abundant forest. Central Liaoning has rich water resources and fertile soil which is the main farming area. The famous ‘West Liaoning Corridor’ has been the vital traffic artery. Liaoning contains rich mineral resources, namely, iron ore and magnesite. The major economic components of Liaoning include agriculture, mining, industry and trade (Liaoning Province, 2011.).

6.2 Population Structure of Liaoning

Liaoning has a population of 42 million according to the 2000 population census. The population structure of Liaoning is analogous to that of China except for an early fertility drop of cohort aged 25-29 for Liaoning as opposed to the cohort of 20-24 for China (see Figure 6.2). This was an effect of the “wan xi shao program” initiated in the early 1970s that encouraged couples to have a late marriage, longer fertility intervals, and fewer children (Akkerman & He, 1998).

The population structure of Liaoning’s city population, town population, and county population are shown in Figure 6.3, Figure 6.4, and Figure 6.5, respectively. The pyramid of city population has shown that there is no bulge for the cohort aged 10-14. This is because a series of population control policies had been well promoted in the urban centers even long before the initiation of the one child policy. The county population pyramid has larger bulges including cohorts aged 10-14, 30-34, 35-39,40-44, and 45-49, compared to their city and town counterparts. This implies that the population control policy had been implemented slowly and was less restricted in the rural region.

6.3 Administrative Structure of Liaoning

Liaoning has 14 prefecture-level cities (see Figure 6.1), divided into 56 city districts, 17 county-level cities, 19 counties and 8 autonomous counties (see Table 6.1). Shenyang, the capital city, is one of the 14 prefecture-level cities. For the purpose of simplicity, Liaoning's prefecture-level cities will be referred to as prefectures in the present research.

There are three levels of the administrative structure of Lioaning province: (1) Prefecture-level city; (2) city-district; county; county-level city; autonomous county; (3) Street; town; township (see Table 6.2). Each prefecture-level city (*shi*) includes an urban-core and a widespread surrounding rural area. The urban-core and its contiguous built-up areas are divided into city districts (*shiqu*). City districts may contain Streets (*jiedao*), towns (*zhen*) townships (*xiang*). The surrounding rural area is divided into counties (*qian*), county-level cities and autonomous counties. A county, county-level city and autonomous county may consist of towns (*zhen*) townships (*xiang*), and autonomous townships (*zizhixiang*) (Liaoning Province, 2011). Generally, the domain of a town is non-agricultural, while the major economic activity of a township is agriculture-based. Ma and Lin (1993) have discussed development of towns in China by using Guangdong Province as a case study. The main criteria for upgrading a township to town were also mentioned in their research. Although towns and townships are in the same administrative level, towns receive more governmental budget from higher level government compared to townships. Generally, towns are more developed than townships and play more important commercial functions.

In addition to the official administrative structure, namely level 1-3 of Liaoning province, in Table 6.2, there also exists level (4) of residential committees and village committees under the Streets, towns and townships. Level (4) is referred to as grassroots organization (Mok, 1988).

The level (4) of grassroots organization structure is utilized for the purpose of postal service and the Census. In regards to population household registration, residents who reside in Street register with residential committees as urban population. Residents who reside in towns register with either residential (or, 'neighborhood') committees or village committees depending on their *hukou* status: urban *hukou* residential committees and rural *hukou* register with village committees. Residents who reside in townships register with village committees (Shen, 1995).

In order to define urban population the 5th National Population Census of 2000 has adopted new criteria:

1) Urban population refers to City Population and the Town Population.

2) Population residing in city districts with an average population density of at least 1,500 persons per square kilometer, is considered urban population.

3) Population of city districts with a population density of less than 1,500 persons per square kilometers, and population of county-level cities, is considered urban if one of the following conditions is met:

i) It is the government seat of the city district or county-level city within the area in question.

ii) A township-level unit, normally considered rural, has a built-up area contiguous to 3i) is considered urban.

iii) Streets in city-districts and in county-level cities are considered urban.

4) For designated towns, the following areas are considered urban:

i) The area is the seat of the town government.

ii) A village-level unit, normally considered rural, has a built-up area contiguous to 4 i) is considered urban.

iii) Residents registered with a residents' (or 'neighborhoods') committee (as opposed to being registered with a village committee) are considered urban residents

(Chan & Hu, 2003)

5) Mining districts, economic development districts (*kaifaqu*), tourist districts, research institutions, and districts with universities or colleges whose residential population exceeds 3,000 (Zhou & Ma, 2003).

6.4 Life Tables for Prefectures, Cities, Towns and Counties of Liaoning

According to Liaoning 2000 population census, individuals and households in each of the 14 prefectures were enumerated according to registration status as residents of city, town, or county. In accordance with this classification, in the present study 56 life tables were constructed, 4 life tables for each prefecture. Of each set of four, the first life table is for the prefectures as a whole, while the other three life tables are for the prefecture population according to household status as being registered as resident of city, town or county.

In the present study, abridged life-tables are used throughout, consistent with prevailing research preference over complete life tables. As opposed to complete life-tables, based on single-year intervals, abridged life tables utilize larger age intervals, usually five-years. In addition, Liaoning Population Census Office provides mortality data in 5-year intervals only.

6.4.1 Data

Since its establishment in 1949, the People's Republic of China has had 5 Population Censuses for which data are available. On Nov 1st, 2010, the 6th Population Census was conducted, but data is not yet available. The first five Chinese censuses were conducted in 1953, 1964, 1982, 1990, and 2000. The 5th population census of China was conducted on November 1, 2000 by China's NBS on a *de jure* basis, i.e. recording nationality and official registered residency place in China (Li& Yu, 2004). China's 2000 population census applied both long form and short form data collection methods. The short form covered basic data for each individual, namely, age, sex, nationality, registration status, and educational attainment level, over 100% of the population. The long form took a ten percent sample of households in most provinces, collecting information on housing, migration, and employment (Lavely, 2001).

Data for Liaoning province follows the same scheme as the rest of China, and Census data is provided by the Liaoning Population Census Office. Data used to calculate life expectancy for Liaoning's prefecture-level cities are from Liaoning 2000 Population Census, published by Liaoning Population Census Office. The data are derived from two sets of tables: Table A01-07 *Population by Age and Sex* and Table A06-01 *Deaths by Sex, Age and Region* (1999.11.1-2000.10.31). Both the population data and the mortality data obtained from these two tables are in 5-year age groups, except for age 0, 1-4 and 100+.

6.4.2 Life Tables for Liaoning's Prefectures

Life tables are constructed based upon observed age-specific mortality rates. The life tables for Liaoning's prefectures are in Tables 6.3 - 6.16. Each of these life tables follows the general outline of *Model Life Tables for Developing Countries* (United Nations, 1982) and UNDP's discussion paper, *Estimating Sub-National Human Development Indices in the Presence of Limited Information: the Case of Bhutan* (2009). Life tables here refer to the one-year period, November 1, 1999 - October 31, 2000. In each life table, the first column identifies age intervals; the second column identifies the number of people in corresponding age groups; the third column includes the number of deaths for each age group. Column 4 refers to the value *M*, the mean death rate for the corresponding age interval; Column 5 refers to the value *q*, probability of dying before the end of the age interval; Column 6 refers to the value *l,* the number of survivors to a specific age from an initial assumed number of births, out of 100,000 newborn children; Column 7 refers to the value *d*, the number of deaths in the age interval; Column 8 refers to value *L*, the number of person-years lived within a given age interval; Column 9 refers to value *T*, the person-years lived by a hypothetical cohort from a given age and onward till the end of life; and Column 10 refers to value *e*, the expectation of life at a given age.

CHAPTER 7
RESULT: LIFE EXPECTANCIES FOR PREFECTURES, CITIES, TOWNS AND COUNTRIES OF LIAONING

7.1 Higher Life Expectancy in Coastal Prefectures

Table 7.1 lists population and life expectancies at birth for the 14 prefectures, and for their cities, towns and counties, as per household registration (*i.e*., not according to the actual residence of the population). According to life expectancies observed in Table 7.1, the 14 prefectures can be classified into three groups. The first group includes prefectures that have life expectancy over 75.50 years, namely, Dalian, Panjin, Huludao, and Yingkou. The second group is comprised of prefectures that have life expectancy between 74-75.50 years, namely, Benxi, Anshan, Liaoyang, Dandong, Jinzhou and Shenyang. The third group contains prefectures with life expectancy that are lower than 74.00 years, namely, Tieling, Fuxin, Fushun, and Chaoyang. For the convenience of comparison, we name these three groups in the present research as *high life expectancy* group, *middle life expectancy* group, and *low life expectancy* group respectively. Among the 14 prefectures, Dalian has the highest life expectancy, namely, 76.86 years, and Chaoyang has the lowest life expectancy of 72.60 years, a difference of 4.26 years. The life expectancies of the 14 prefectures, as per Table 7.1, are shown in Figure 7.1.

It is worth noting that in Liaoning Province, life expectancy of coastal prefectures is generally higher than that of the inland prefecture-level cities. All of the prefectures in the *high life expectancy* group are coastal prefectures with a trading port. All of the prefectures in the *low life expectancy* group are interior prefectures. The *middle life expectancy* group is a mixed group with coastal prefecture of Jinzhou, border city of Dandong, and four inland prefectures, Benxi, Anshan, Liaoyang and Shenyang (see Figure 7.2).

7.2 Higher Life Expectancy in Urban Areas

The life tables for Liaoning's 14 prefectures, as per Table 7.1, indicate that there is a significant life expectancy gap between the city, town, and county population within prefectures. In Liaoning, in the census year 2000, the average life expectancy of city populations was 76.91 years, compared to the average of 75.64 years for town populations, and the average of 73.00 for county populations. The life expectancy gap between city population and town population is relatively small with an average difference of 1.27 years. The difference in life expectancy between city population and county population is relatively big, 3.91 years as shown in Table 7.1.

In order to show the life expectancy gap among city, town and county population, Figure 7.3 was made based on Table 7.1. The average life expectancy for each prefecture was set as the standard line. A positive bar indicates a higher life expectancy above the prefecture's average, while a negative bar indicates a lower life expectancy below the prefecture's average. All city populations in the 14 prefectures have positive bars as shown in Figure 7.3. Also, the town populations in most of the prefectures have positive bars as well, except for Dalian and Chaoyang prefectures with a slightly lower life expectancy in towns than the prefecture's average value. The only case where life expectancy of a town population is higher than that of a city population is Anshan prefecture, even though the difference, 0.25 years, is very small. This could imply a good level of development and standard of living in Anshan's towns. All 14 prefectures' county populations have negative bars with lower life expectancy compared to their counterparts in cities and towns. This implies lower level of socioeconomic development in Liaoning's rural areas.

Among all 14 prefectures, Benxi has the biggest life expectancy gap (see Table 7.1 and Figure 7.3), 7.34 years, between its city and county population. The average life expectancy of

Benxi's city residents has reached 78.94 years in 2000, ranked the fourth among all prefectures. But, the life expectancy of Benxi's county population is only 71.6 years, ranked the 13th out of the 14 prefectures. This large life expectancy gap indicates that the development of Benxi's rural areas is far behind that of Benxi's urban areas.

The table and figures in this section has shown the geographical pattern of life expectancy in Liaoning province. Coastal prefectures have higher life expectancy than inland prefectures, and urban areas have higher life expectancy than rural areas. This is consistent with identical geographical pattern of life expectancy in China as a whole discussed in Banister and Zhang (2005), and Li and Dorsten (2010)'s studies. It is noteworthy that a differential pattern has been identified also in fertility between urban and rural areas of Guangdong province, and a geographic pattern in fertility between mountain and delta regions (Akkerman & He, 1998).

CHAPTER 8
DISCUSSION: LIFE EXPECTANCY AND WELLBEING FOR LIAONING'S PREFECTURES

Life expectancy is affected by many socio-economic factors, the most important among them being income, education, sanitary conditions, and access to and quality of health care (Banister & Zhang, 2005; Ogwang, 1994; Xinming Song, et al., 2010; Sutherland & Yao, 2011). In Liaoning province, differences in life expectancy across prefectures and between urban and rural areas are determined by additional three factors: imbalanced economic development among regions, unequal access to health care, and the industrial and geographical differences between the coastal and inland prefectures.[2]

8.1 Regional Development Disparities in Liaoning Province

8.1.1 Imbalanced Economic Development across Regions

The result has shown that, in Liaoning province, life expectancy in coastal regions is higher than that of inland regions, and life expectancy in urban areas is higher than that of rural areas. This geographic life expectancy pattern is consistent with Liaoning's economic development pattern.

Undoubtedly, there are direct causes for the different levels of life expectancy throughout Liaoning. The present study, however, does not seek out causal relationships between life expectancy and various socio-economic or environmental factors and, rather, it provides a descriptive means of evaluation of human development. This study, accordingly, does not utilize

[2] Quality or protein content of food might be a major consideration in some regions of China, or the world, when discussing differences in life expectancy. Access to seafood is a major factor in such considerations. In the case of Liaoning, seafood consumption across the province is relatively equal due to convenient transport between coastal areas and inland prefectures of the province.

regression analysis but uses a descriptive ranking of corresponding values of life expectancy. From this perspective, regression is not relevant or necessary.

In Liaoning province, the coastal prefectures are generally more economically advanced than the inland prefectures due to the favourable economic development policies. In order to attract foreign investment both China's central government and the provincial government of Liaoning have implemented, since the 1978 economic reform, a series of preferential policies for coastal regions, namely, tax reduction and exemption to investors and enterprises, as well as duty-free trade to selected areas from within the coastal regions. As early as 1984, the prefecture-level city of Dalian was chosen as one of China's 14 pioneer coastal cities for foreign direct investments.[3] Through the years, Dalian has attracted investment from many countries worldwide such as Japan, Republic of Korea, and the United States (Roberts & Kanaley, 2006). In 2005, the government of Liaoning initiated the 'Five Points and One Line'[4] development strategy in order to further promote economic development in the coastal regions. The government believes that the economic growth in the coastal regions will spread into the inland prefectures and further drive the overall economic development of the province. In 2009 China's State Council has approved 'Liaoning Coastal Economic Belt Development Plan' (the formal 'Five Points and One Line' strategy) as part of China's national development strategy. This implies that Liaoning's coastal regions and coastal prefectures will grow even faster with the financial and policy support from the central and provincial governments.

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[3] The 14 pioneer coastal cities are Dalian, Qinhuangdao, Tianjin, Yantai, Qingdao, Lianyungang, Nantong, Shanghai, Ningbo, Wenzhou, Fuzhou, Guangzhou, Zhanjiang, and Beihai (Chen, 1996).

[4] The 'Five Points' refer to five coastal development zones: Danlian Changxing Island Harbor Industrial Zone; Yingkou Coastal Industrial Base; Liaoxi Jinzhou Bay Coastal Economic Zone; Dandong Industrial Park; and Dalian Zhuanghe Huayuankou Industrial Zone. And the 'One Line' refers to the construction of a coastal highway connecting the above 'Five Points'.

In contrast to the coastal prefectures, Liaoning's inland prefectures have experienced difficulties in attracting foreign investment due to the lack of preferential policies. Compared to their coastal counterparts the inland cities, not having been selected as the 'target regions' for the provincial development plan; have been progressing at a much slower pace. According to China's national standard of poverty, there are 15 counties or county-level cities in Liaoning provinces classified as National-level Poor Counties.[5] Most of the poor counties exist in the prefectures that belong to the *low life expectancy* group. For example, Chaoyang prefecture has the lowest life expectancy among Liaoning's 14 prefectures, while 5 out of the 15 poor counties are located in Chaoyang prefecture. In contrast, none of the poor counties exist in the *high life expectancy* coastal prefectures such as Dalian, Panjin, Huludao and Yingkou.

Many of Liaoning's inland prefectures such as Shenyang and Anshan are heavy-industrial based with a high concentration of state-owned enterprises (SOE). Since the mid 1990s, Liaoning's large scale state-owned enterprises had experienced restructuring aimed at improving efficiency and resiliency under market economy. Between 1999 and 2004, more than 27.8 million workers in SOEs had been laid off in China (Chan, Ngok, & Phillips, 2008). In the period1998 - 2000, over 3 million workers were laid off in Liaoning province alone (Li, 2008). Many laid-off workers were in their middle age with families to support. Although most of the laid-off workers had received modest pension or relief funds, the average household income for families of these workers had dropped significantly to less than one-fourth of the average household income of a common family in the urban area (Kou & Yuan, 2009). These families

[5] These 15 National-level Poor Counties are Chaoyang County, Jianchang County, Jianping County, Xinbin Manchu Autonomous County, Yi County, Kalaqin Left Wing Mongolian Autonomous County, Kangping County, Xiuyan Manchu Autonomous County, Huanren Manchu Autonomous County, Beipiao County-level City, Lingyuan County-level City, Fuxin Mongolian Autonomous County, Zhangwu County, Qingyuan Manchu Autonomous County, and Xifeng County.

have become the new urban poor, and largely concentrated in Liaoning's industrialized prefectures, namely, Shenyang, Anshan, Fushun, Benxi, Liaoyang, and Tieling.

Liaoning's development gap exists not only across prefectures, but also between the urban and rural areas. Like elsewhere in China, Liaoning's development policies have been urban focused. The urban-favored economic and social policies have caused a great gap in the level of development between the urban and rural areas in Liaoning province. For example, Liaoning's urban GDP per capita in 2003 was 19,595 Yuan, while the rural GDP per capita was only 7,941 Yuan (UNDP, 2005). Furthermore, the rural local governments are often eager to achieve economic success and therefore ignore the ecological impact on farmland and natural environment. Recent research on Liaoning's rural ecological and environmental conditions has revealed that the living conditions in many rural areas have deteriorated over the years due to the increase of rural domestic garbage, and air and water pollution from the local industrial enterprises (He & Zhao, 2008). Additionally, Liaoning's urban and rural development gap is even larger when social development such as health care is considered.

8.1.2 Unequal Access to Health Care between the Urban and Rural Areas

The previous research has indicated that the health of the urban population in Liaoning province is better than that of the rural population (Zhao, 2005). This urban-rural health disparity is caused not only by economic discrepancies such as GDP per capita and household income, but also by the unequal access to health care between the urban and rural residents.

During the 1960s and 1970s, nearly 90 percent of Chinese had some kind of medical coverage. In urban areas, residents held health coverage either under the government insurance scheme (*Gongfei Yiliao*) financed directly by various levels of government, or under labor insurance scheme (*Laobao Yiliao*) provided by state-owned enterprises. In rural areas, more than

90 percent of the residents were covered by the cooperative medical system (*Hezuo Yiliao*), which was heavily subsidized by the collective welfare funds (Zhao, 2006).

Both the urban labour insurance scheme and the rural cooperative medical system collapsed in the early 1980s (Wu 2003; Tang and Wu 2000; Lai, 2003). With the gradual adoption of market economy, Chinese national government, over the period 1985-2000, was compelled to reduce the availability of low-cost health care and social services. The responsibility was turned over to the provincial, sub-provincial and local governments. For example, the percentage of personal health care expenditure in the whole health expenditure in China has increased sharply, from 21.2 percent in 1980 to 35.7 percent in 1990 and to 59 percent in 2000 (Hui & Bun, 2010). Correspondingly, the government share of medical care has decreased from 36.2 percent in 1980 to15.5 in 2000. The percentage of rural residents who had access to basic health care dropped from nearly 90 percent to less than 10 percent in recent years (Riley, 2004; Zhao, 2006).

Increase in medical costs and the out-of-pocket expenses for health care have prevented many poor people from seeking medical service in Liaoning province. Previous studies on Liaoning have shown that medical expense is the number one reason that has forced the urban and rural poor families to borrow loan (Kou & Yuan, 2009). For many poor rural residents, it is difficult seeking medical care and it is costly to see a doctor.

In rural Liaoning, the physical living conditions such as the access to running water and sanitary toilet facilities is still below China's national average standard. In addition, Liaoning's rural medical institutions have lagged behind their urban counterparts. There are far fewer doctors, medical personnel and hospitals beds available in the rural areas. In Liaoning's rural areas, for the year 2001, the maternal mortality rate was 21 per 100,000 pregnant women in the urban areas, while the number for the rural pregnant women was 29. In urban areas, over 96 percent of new born babies were delivered in hospital. In contrast, more than 20 percent of the rural babies are delivered by midwives, or even family members at the mothers' homes, rather than in hospitals. The infant mortality rate in urban Liaoning was 10.8 per 1000 live births, while the rural infant mortality rate was 17.7 for the same time period (Jiang, 2003).

The case study of Liaoning province has reflected the overall inequality of China's medical care across regions and between the urban and rural areas. The ranking of China by its HDI in 2000, showing its rank as 96 among 173 countries, would suggest that China is a country within a medium HDI (HDR, 2002). But, the same year World Health Report revealed that the overall performance of Chinese health system ranked only 144 among 191 countries worldwide, and 188 in terms of the equity of health care financing (WHO, 2000). China's health development has obviously lagged behind its economic development in terms of quality and accessibility of medical care.

8.1.3 Industrial and Geographical Differences Between the Coastal and Inland Regions

For many heavy industry based cities, air and water pollution are common. Accordingly, pollution-related diseases and mortality is relatively high. Environmental pollution is one of the biggest problems for heavy industrial cities such as Shenyang, Anshan, and Fushun. Shenyang was identified by the WHO, in 1988, as one of the 10 most polluted cities in the world with severe air and water pollution (Roberts & Kanaley, 2006). A study in Shenyang has shown that there was a positive association between air pollution and the mortality rate (Xu, Yu, Jing, & Xu, 2000). Although heavy-industry based prefecture-level cities in Liaoning, namely, Shenyang, Anshan, and Fushun, have relatively high GDP per capita, their residents face higher chances of getting pollution-related illness such as respiratory chronic disease compared to the residents who live in cleaner coastal regions. A recent study by Lu, Gu and Chen (2008) has concluded that there is a positive relationship between the uncontaminated coastal living environment and life expectancy in China. As long as coastal areas of Liaoning remain uncontaminated, their ecology will remain of higher quality than that of their inland counterparts, and therefore life expectancy can be assumed to remain higher as well.

8.2 Life Expectancy vs. GDP per capita, and vs. HDI

Observation of Tables 7.1, Figure 7.1 and Figure 7.2 show clear disparities in life-expectancy across Liaoning's 14 prefectures, and their populations classified by rural or urban status, as well as by geographic classification according to coastal and inland location. Both observations of regional disparities within Liaoning are consistent with the conventional view on regional disparities in development across China (Li & Dorsten, 2010). Furthermore, GDP as a regional indicator of development may not be as comprehensive as life expectancy. Worse yet, for China, HDI as a regional development indicator is incapable of showing any distinction within its *Medium* category, while the spatial distribution of life expectancies across China provides an opportunity for just such refinement in classification.

8.2.1 Life Expectancy vs. GDP per capita

Compared with GDP per capita, life expectancy represents a more complete development picture. This is due to the fact that GDP per capita does not take into consideration important social and environmental factors such as industrial and air pollution, health coverage, and education. Life expectancy, on the other hand, is directly affected by a compendium of factors such as income, sanitary conditions, access to medical care, educational attainment, and environmental conditions. Ranking prefectures by GDP per capita and by life expectancy could be, therefore, significantly different. The ranking of Liaoning prefectures by GDP per capita, 1999, shows Shenyang and Fushun ranked the 3rd and the 5th among the 14 prefectures (see Table 8.1). But according to life expectancy for 2000, their rank dropped to 10th and 13th, respectively.

8.2.2 Life Expectancy vs. HDI

Compared with the HDI, life expectancy better identifies the regional development disparities between China's provinces. As mentioned in section 2.1.2.2, according to the UNDP, HDI has been classified into the following four categories: *Low*, *Medium*, *High*, and *Very High*. For the entirety of China's provinces, throughout the observed period of 1995-2008, the category "Low HDI" does not apply at all. For the years, 1995, 1997, and 1999 the development profile of China's provinces could be described through two HDI categories only, *Medium* and *High* (see Figure 8.1). For these years the majority of China's provinces fell into the *Medium* HDI category, with only Shanghai and a few other provinces attaining the High HDI value.

According to the HDI classification UNDP, shown in Table 4.1, commencing in 2003, China's provinces have attained three out of the four HDI categories. For the years 2003 and 2006 the vast majority of provinces fell into the *Medium* HDI, a few more provinces moved up into the *High* HDI group, and Shanghai was the only one classified as attaining the *Very High* HDI group. Finally, for the year 2008, almost half of the provinces in mainland China had *Medium* HDI and half of the provinces were considered as having *High* HDI, and with the *Very High* HDI applicable to Shanghai only. According to the existing HDI classification, most of China's provinces thus fall into either *medium* or *high* HDI groups, while the great development gap within each group is entirely ignored. For example, both Tibet and Liaoning province were in the medium HDI group in 1995, as shown in Figure 8.1, while the life expectancy for the two provinces was 59.8 and 70.8 years respectively.

There can be little doubt, therefore, that the HDI is a very crude and insensitive measure, incapable of recording finer development differences between regions. Figure 8.2 shows China's mainland provinces distributed according to four alternative categories, namely their life expectancy values: below 68, 68-71, 71-74, and 74+. Compared to Figure 8.1, showing a very crude HDI distribution by province, Figure 8.2 shows a much more refined distribution of China's provinces, by life expectancy categories, thus better reflecting regional disparities. The benefit for such an alternative is evident especially for the four most recent years, 1999, 2003, 2006, and 2008. In addition, unlike the HDI, life expectancy retains an objective and universal significance, in the sense that it is always comparable over years, between and within countries. HDI possesses little value in context of policy and planning, for China, in particular, and even less so for its provinces, Liaoning specifically.

Currently, there are no HDI values available for Liaoning's prefectures. But given the poor quality of the HDI one could hardly assume that Liaoning's 14 prefectures would fall within more than one single HDI category. The value of such a development measure for research, policy, and planning is virtually nil. As shown in Figure 8.2, for China as a whole, and in Figure 7.2, for Liaoning, life expectancy, on the other hand, provides a clear, refined measure of development disparities.

Additionally, as one of the three dimension of the HDI, educational data is not comparable across China's provinces and between urban and rural areas due to the severe discrepancy in the quality of education. For instance, in some of the villages in Yunnan province, there were only one or two teachers available in the village school, who teach "all subjects at all grade levels" (Fu, 2005), [6] and the quality of education in large metropolitan region and in small villages is not comparable.

Furthermore, in recent years, China has experienced surging university enrolment. According to Johnson (2009), there were 3.4 million Chinese people attending universities in 1998, while the number gushed to 21.5 million in 2008. The booming number of students has led not only to overcrowded classrooms and campuses, but also to difficulty finding jobs after graduation. Among the 5.6 million of 2008 university graduates, almost 2 million were still looking for jobs in early 2009. At the same time, university enrolment has been increasing year after year since early 2000, up to 30% a year. The number of university graduates in China has exceeded the labour market demand. Some of the unemployed university students choose to attend graduate school as a temporary solution. In the case of China, longer mean years of schooling and expected years of schooling could be a reluctant choice for an individual and not necessary lead to better employment opportunities and quality of life.

[6] Although similar situations can be seen in much of North American rural areas, the number of teachers per student is usually much higher in comparison to China. In contrast, there is a shortage of teachers in China's rural areas, especially in poor villages. China's rural schools have insufficient funding, outdated equipment, and the overall qualifications of teachers are lower compared to the ones who teach in urban schools (Fu, 2005).

CHAPTER 9

CONCLUSION AND IMPLICATIONS FOR FURTHER RESEARCH

9.1 Conclusion

In recent years, the need to monitor and measure development has led to a proliferation of indicators (Khalifa & Connelly, 2009). An increasing number of composite indicators such as HDI have been often used and cited in governmental reports and academic research. Through the 1990s up until the present time it has become increasingly apparent, however, that the HDI is of questionable value both due to its methodology and its components. The present study further develops previous criticism aimed at the HDI, within the particular context of China.

Not only are there serious questions arising with regard to the methodology and duplicity of components, as past studies have shown, and as this study shows in Sections 2.1.2.2.1, but in the particular case of China HDI appears to be almost entirely inadequate. Present research argues that HDI hides severe inequality within China, and, in particular it lacks policy relevance at sub-provincial levels such as prefectures. In addition, UNDP keeps changing the methodology of the HDI so that HDI values over time are not comparable and thus unfit for research or planning. In the case of China and its sub-national regions such a predicament is mostly acute. Furthermore, at both the international and sub-national level, ranking China or its provinces by HDI, GDP per capita and life expectancy have shown identical results. Therefore, it is not necessary to use HDI at prefecture-level since GDP per capita and life expectancy are simpler indicators and offer similar information. Additionally, the calculation of the HDI in its present form requires large sets of statistics data that would necessitate extensive governmental expenditure, a situation entirely impractical for many prefectures in China.

In response to the existing deficiencies in the HDI the present research makes a suggestion to use life expectancy at China's sub-national level, and examines the application of life expectancy at the prefecture-level, for the province of Liaoning. Contribution of the present research to the measurement of development in China, and in Liaoning province in particular, using life expectancy may be summarized as follows:

As a development indicator, life expectancy mirrors health, wellbeing and overall standard of living of the population. For numerous reasons, Liaoning, as most other provinces, has no HDI data available for its sub-provincial level, and at the prefecture level Liaoning, as well as other provinces, has used GDP per capita as a development indicator. GDP per capita used in Liaoning province up until now, however, ignores environmental quality and social development such as health care. Life expectancy has been shown here as a viable alternative and complement to GDP per capita, particularly for Liaoning's sub-provincial regions. As a development indicator life expectancy can be interpreted as measuring progress and standard of living between sub-provincial regions and smaller populations, such as those in Liaoning's prefectures. GDP per capita can only measure regional growth from an economic perspective, while the combination of economic indicators with social indicators such as life expectancy can measure regional development comprehensively.

In addition, the geographic pattern of life expectancy in Liaoning has shown that there is a significant development gap between Liaoning's prefectures and between its urban and rural areas. Under the preferential policies for coastal regions, both at the national and provincial level, coastal prefectures such as Dalian in Liaoning have enjoyed fast growth accompanied by increased life expectancy. In Liaoning, on the other hand, poverty has remained in some inland prefectures, particularly, Fuxin and Chaoyang. Similar preferential economic and social policies have also led to disparities between Liaoning's urban and rural regions, as has been the case in the rest of China too.

Whereas the ranking of Liaoning prefectures by GDP per capita is different than the ranking of prefectures by life expectancy, the geographic pattern of distribution of life expectancy (see Figure 7.2) and GDP per capita (see Figure 9.1), across the fourteen prefectures of Liaoning, appears to be somewhat different. For smaller areas, GDP may not be always available and reliable, across China or elsewhere in the world. Data required for the calculation of life-expectancy, however, is usually easily accessible from government or hospital statistics on births and deaths. The advantage of life-expectancy as a development measure for small-area multitudes, over HDI, is incontestable, but the suggestion that such an advantage of life expectancy exists also against the GDP, emerges precisely from the present study. Therefore, life expectancy can be seen as a valid and practical indicator to measure the level of human development for Liaoning's prefecture-level cities when HDI is not available.

9.2 Implications for Further Research

Since the 1978 economic reforms the urban-rural development gap in China has been continuously widening. Moreover, throughout China most hospitals, doctors, nurses and medical personnel are concentrated in urban areas, and thus China's urban populations attain higher life expectancy than their rural counterparts. In Liaoning province, too, due to better access to health care and higher percentage of health insurance coverage in urban areas, Liaoning's urban population has higher life expectancy than its rural population. Since 2005 the central government of China has been engaged in the return of the cooperative health insurance system, which was in effect until 1980s, for the rural families. In order to monitor the impact of the rejuvenated health insurance system upon Liaoning's rural populations, the most expedient measure is the life expectancy.

Since Liaoning is one of China's oldest industrial bases, many of its prefectures have faced problems of air and water pollution and ecological damage. However, in recent years, a series of programs and policies have been initiated by both local governments and enterprises in order to restore the environment and achieve sustainable development in Liaoning province. Life expectancy could be a useful tool to assess the connections between the healthy living environment and people's life expectancy.

Whereas the HDI is entirely ineffectual as an intra-provincial development indicator in China, the GDP cannot fully substitute as a comprehensive development measure of smaller areas or smaller populations within China's provinces. Utilizing GDP only in the formulation of regional policies and planning can be, therefore, expected to yield biased results, counterproductive to the health and overall wellbeing of the population. Life expectancy, as a companion measure to the GDP carries a significant complementary value precisely in social aspects that the GDP does not address. Future research, therefore, should focus on application of life expectancy to smaller geographic areas, such as counties, towns or townships, within Liaoning province. Similarly, future application needs to be considered in regard to different socioeconomic groups in the province, and throughout China as a whole.

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APPENDIX

METHODOLOGY OF LIFE TABLES

The following provides details on the adjusted Chiang's method for the construction of life tables (Chiang, 1968; 1978). This approach was used in the UNDP's discussion paper (Gampat and Sarang, 2009), and is shown in Table A as follows:

Age Groups (Column 1)**:** age in years between the lower and upper limit of the age interval. It is denoted by i. According to Eayres and Williams (2004), the final age group for small population should be 85+.

$$i = 0 \text{ to } \omega$$

where ω is a positive infinity and it is equivalent to the maximum life span.

The initial age x of the age interval (Column 2): x is the initial age of the age groups.

Interval width n (Column 3): the length of the age groups, denoted by n_i. In the abridged life tables, n equals five years with the exception of the age 0 group (one year), second interval (four years), and last interval 85+ (open-ended).

Fraction a_x of age intervals (Column 4)**:** as deaths are usually assumed to be evenly distributed during the age interval, this column usually has the fraction 0.5, denoted by a_i. The fraction for age group 0 is set to 0.1 since most deaths occur during delivery or right after birth.

$$a_i=0.1 \text{ for } i=0 \text{ and } a_i=0.5 \text{ for } i=1,2\dots\omega$$

Population (Column 5) and Deaths (Column 6): the actual population and number of deaths recorded in the study population for the age interval i. The data for the population and deaths in the present research was achieved from Liaoning 2000 Population Census.

Annual death rate M in interval (Column 7)**:** mean death rate for the corresponding age interval, denoted by M_i.

$$M_i = \text{Number of Deaths in the interval/ Population for age groups}$$

Probability q_i ***of dying in age interval (Column 8):*** the probability of an individual at age x dying before the end of the age interval i, it is denoted by q_i.

$$q_i=\frac{n_i M_i}{1+(1-a_i)n_i M_i}$$

Probability of surviving in age interval (Column 9)**:** the probability of an individual at age x will survive during the age interval i. It is denoted by p_i.

$$p_i= 1-q_i$$

Number of survivors at the start of the age interval (Column 10): the number of individuals of the hypothetical cohort alive at the start of the age interval, with an initial assumed number of births, of 100,000 newborn children. It is denoted by l_i.

$$l_i=100,000 \text{ for } i=0$$

$$l_i= l_{i-1}p_{i-1} \text{ for } i=1,2\ldots.\omega$$

Number of deaths in the age interval (Column 11)**:** number of persons in the hypothetical cohort dying in the age interval i, denoted by d_i.

$$d_i=l_i-l_{i+1} \text{ for } i=1,2\ldots.\omega$$

$$d_i=1 \text{ for } i=\omega$$

Number L_i ***of years lived in the interval i (Column 12)*****:** the number of person-years lived during the interval i, denoted by L_i.

$$L_i= n_i(l_i-d_i)+a_in_id_i \text{ for } i=1,2\ldots.\omega$$

$$L_i=l_i/M_i \text{ for } i=\omega$$

Total number of years lived beyond the start of the age interval i (Column 13)**:** the total number of person years that will be lived by people of the hypothetical cohort who are alive from a given age onward till the end of life, denoted by T_i.

$$T_i=T_{i+1}+L_i \text{ for } i=1,2\ldots.\omega$$

Expectation of life at the start of the age interval (Column 14)l**:** the average number of years that each member of the cohort alive at the start of the interval can expect to live, denoted by e_i.

$$e_i=T_i/l_i \text{ for } i=1$$

Appendix Table A. Abridged Life-table for 5-year Age Intervals, Liaoning Province, 2000

Age groups	x	n	ax	population	deaths	M_x	q_x	p_x	l_x	d_x	L_x	T_x	e_x
0	**0**	**1**	**0.1**	351528	3396	0.0097	0.0096	0.9904	100000	958	99138	7480697	74.81
1-4	**1**	**4**	**0.5**	1405636	1412	0.0010	0.0040	0.9960	99042	397	395375	7381559	74.53
5-9	**5**	**5**	**0.5**	2276964	760	0.0003	0.0017	0.9983	98645	164	492814	6986184	70.82
10-14	**10**	**5**	**0.5**	3358907	1018	0.0003	0.0015	0.9985	98481	149	492030	6493370	65.94
15-19	**15**	**5**	**0.5**	2922880	1441	0.0005	0.0025	0.9975	98331	242	491052	6001340	61.03
20-24	**20**	**5**	**0.5**	3072999	2270	0.0007	0.0037	0.9963	98089	362	489543	5510288	56.18
25-29	**25**	**5**	**0.5**	3570207	3077	0.0009	0.0043	0.9957	97728	420	487588	5020745	51.37
30-34	**30**	**5**	**0.5**	4108556	4525	0.0011	0.0055	0.9945	97308	534	485202	4533156	46.59
35-39	**35**	**5**	**0.5**	4298382	6365	0.0015	0.0074	0.9926	96773	714	482081	4047955	41.83
40-44	**40**	**5**	**0.5**	3898754	8614	0.0022	0.0110	0.9890	96059	1055	477658	3565874	37.12
45-49	**45**	**5**	**0.5**	3620222	11280	0.0031	0.0155	0.9845	95004	1469	471348	3088215	32.51
50-54	**50**	**5**	**0.5**	2361258	11457	0.0049	0.0240	0.9760	93535	2242	462072	2616867	27.98
55-59	**55**	**5**	**0.5**	1712280	13873	0.0081	0.0397	0.9603	91293	3625	447404	2154796	23.60
60-64	**60**	**5**	**0.5**	1568633	21306	0.0136	0.0657	0.9343	87668	5758	423946	1707392	19.48
65-69	**65**	**5**	**0.5**	1305806	31091	0.0238	0.1124	0.8876	81910	9203	386542	1283445	15.67
70-74	**70**	**5**	**0.5**	989046	39094	0.0395	0.1799	0.8201	72707	13077	330840	896903	12.34
75-79	**75**	**5**	**0.5**	585400	37288	0.0637	0.2747	0.7253	59630	16382	257192	566063	9.49
80-84	**80**	**5**	**0.5**	270711	28603	0.1057	0.4179	0.5821	43247	18073	171053	308871	7.14
85+	**85**	**17**	**0.5**	146243	26713	0.1827	1.0000	0.0000	25174	25174	137818	137818	5.47
				41824412	253583						7480697		

Source: Table A01-07, Table A06-01, Population Census Office，Liaoning Province, 2002

Table 2.1 UNDP Human Development Indices and Component Indicators

Name	Dimensions	Component Indicators
Human Development Indicator (HDI)	Health	Life expectancy at birth
	Education	Adult literacy rate; Gross enrolment ratio
	Economic wellbeing	GDP per capita (PPP US$)
Human Poverty Index (HPI-1)	Health	Probability at birth of not surviving to age 40
	Education	Adult illiteracy rate
	Economic wellbeing	Percentage of population not using improved water sources; percentage of children under five who are underweight
Human Poverty Index (HPI-2)	Health	Probability at birth of not surviving to age 60
	Education	percentage of adults lacking functional literacy skills
	Economic wellbeing	Percentage of people living below the poverty line
	Social Exclusion	Long-term unemployment rate
Gender Development Indicator (GDI)	Health	Female life expectancy at birth; Male life expectancy at birth
	Education	Female adult literacy rate; Female gross enrolment rate; Male adult literacy rate; Male gross enrolment rate
	Economic wellbeing	Female estimated earned income; Male estimated income
Gender Empowerment Measurement (GEM)	Political Rights	Female and male shares of parliamentary seats
	Economic rights	Female and male shares of positions as legislators, senior officials and managers; Female and male shares of professional and technical positions
	Power over economic resources	Female and male estimated earned income

Source: UNDP HDR 2002

Table 3.1 Administrative Division, China, 2010

No.	Provinces	Population (10 000)
	Northern Region	
1	Beijing (Municipality)	1257
2	Tianjin (Municipality)	959
3	Hebei	6614
4	Shanxi	3204
5	Inner Mongolia (Autonomous Region)	2362
	Northeastern Region	
6	Liaoning	4171
7	Jilin	2658
8	Heilongjiang	3792
	Eastern Region	
9	Shanghai (Municipality)	1474
10	Jiangsu	7213
11	Zhejiang	4475
12	Anhui	6237
13	Fujian	3316
14	Jiangxi	4231
15	Shandong	8883
	Central and Southern Region	
16	Henan	9387
17	Hubei	5938
18	Hunan	6532
19	Guangdong	7270
20	Guangxi (Autonomous Region)	4713
21	Hainan	762
	Southwestern Region	
22	Chongqing (Municipality)	3075
23	Sichuan	8550
24	Guizhou	3710
25	Yunnan	4192
26	Tibet (Autonomous Region)	256
	Northwestern Region	
27	Shaanxi	3618
28	Gansu	2543
29	Qinghai	510
30	Ningxia (Autonomous Region)	543
31	Xinjiang (Autonomous Region)	1774

Source: NBS, China

Table 3. 2 Themes of CHDRs

Year	Themes
1997	Poverty Alleviation and Human Development
1999	Transition and the State
2002	Making Green Development A Choice
2005	Towards Human Development with Equity
2007/08	Access for All: Basic Public Services for 1.3 Billion People
2009/10	China and a Sustainable Future: Towards a Low Carbon Economy and Society

Source: UNDP 1997-2010

Table 4.1 China's National HDI, 1960-2010

Year of HDR \ Year of HDI	1960	1970	1975	1980	1985	1987	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1990						0.716																					
1991					0.614																						
1992							0.566																				
1993							0.566																				
1994									0.644																		
1995									0.594																		
1996										0.609																	
1997	0.248	0.372		0.475					0.644		0.626																
1998	0.248	0.372		0.475					0.644			0.65															
1999			0.521	0.554	0.588		0.624							0.701													
2000			0.518	0.548	0.584		0.619								0.706												
2001			0.522	0.553	0.59		0.624					0.679				0.718											
2002			0.523	0.554	0.591		0.625					0.681					0.726										
2003			0.521	0.554	0.591		0.624					0.679						0.721									
2004			0.523	0.557	0.593		0.627					0.683					0.721		0.745								
2005			0.525	0.558	0.594		0.627					0.683								0.755							
2006			0.527	0.56	0.596		0.628					0.685					0.73				0.768						
2007/08			0.53	0.559	0.595		0.634					0.691					0.732					0.777					
2009				0.533	0.556		0.608					0.657					0.719					0.756	0.763	0.772			
2010		0.349	0.389	0.433	0.478		0.514					0.58					0.636					0.677					0.718

Source: Data from UNDP, 1990-2010

Table 4.2 List of Major Methodological Changes of the HDI, 1990-2010

HDR	Composing indicators	Limits		Method
		Max	Min	
1990	Life Expectancy (Years)	78.4	41.8	Step 1:
	Adult Literacy rate (%)	100	12.3	$I_{ij} = \frac{(\max X_{ij} - X_{ij})}{(\max X_{ij} - \min X_{ij})}$
	Real GDP per capita (log)	3.68	2.34	
1991	Life Expectancy (Years)	78.6	42	
	Adult Literacy rate (%)	70.1	9.1	
	Mean Years of Schooling			Step 2:
	Adjusted Real GDP per Capita	5,070	350	$I_j = \sum_{i=1}^{3} I_{ij}$
1992	Life Expectancy (Years)	78.6	42	
	Adult Literacy rate (%)	3	0	
	Mean Years of Schooling			
	Adjusted Real GDP per Capita	5,079	380	Step 3:
1993	Life Expectancy (Years)	78.6	42	$(HDI)_j = (1 - I_j)$
	Adult Literacy rate (%)	3	0	
	Mean Years of Schooling			
	Adjusted Real GDP per Capita	5,075	367	
1994	Life Expectancy (Years)	85	25	Step 1:
	Adult Literacy rate (%)	100	0	$I_{ij} = \frac{(\max X_{ij} - X_{ij})}{(\max X_{ij} - \min X_{ij})}$
	Mean Years of Schooling	15	0	
	PPP-adjusted GDP per capita (US$)	40,000	200	
1995-2009	Life Expectancy (Years)	85	25	Step 2:
	Adult Literacy rate (%)	100	0	$I_j = \sum_{i=1}^{3} I_{ij}$
	Combined Enrolment Ratio (%)	100	0	
	Real GDP per capita (PPP$)	40,000	100	
2010	Life Expectancy (Years)	83.2	20	Step 1: $I_{ij} = \frac{(\max X_{ij} - X_{ij})}{(\max X_{ij} - \min X_{ij})}$
	Mean Years of Schooling	13.2	0	
	Expected Years of Schooling	20.6	0	Step 2:
	GNI per capita (PPP US$)	108,211	163	$HDI = \sqrt[3]{I_{Life} \times I_{Education} \times I_{Income}}$

Source: UNDP 1990-2010

Table 4.3 Ranking Differences between China's HDI, GNP, and GDP, 1990-2010

Year of HDR	Ranking Differences	Year of HDI
1990	44 (GNP-HDI)	1987
1991	51 (GNP-HDI)	1985
1992	51 (GNP-HDI)	1990
1993	41 (GNP-HDI)	1990
1994	49 (GNP-HDI)	1992
1995	12 (GDP-HDI)	1992
1996	3 (GDP -HDI)	1993
1997	3 (GDP -HDI)	1994
1998	1 (GDP - HDI)	1995
1999	6 (GDP-HDI)	1997
2000	7 (GDP-HDI)	1998
2001	7 (GDP-HDI)	1999
2002	0 (GDP-HDI)	2000
2003	-2 (GDP-HDI)	2001
2004	5 (GDP-HDI)	2002
2005	11 (GDP-HDI)	2003
2006	9 (GDP-HDI)	2004
2007/08	5 (GDP-HDI)	2005
2009	10 (GDP-HDI)	2007
2010	-4 (GNI-HDI)	2010

Source: UNDP 1990-2010

Table 4.4 Comparison of Rankings of the HDI and GDP, Provinces, China, 1990

Provinces	HDI	HDI Rank	GDP per capita	GDP Rank	Ranking Difference Between GDP and HDI
Shanghai	0.861	1	6376.89	1	0
Tianjin	0.788	2	3907.06	2	0
Beijing	0.769	3	3478.70	3	0
Liaoning	0.701	4	2911.14	4	0
Guangdong	0.681	5	2584.21	5	0
Zhejiang	0.640	6	2289.64	6	0
Jiangsu	0.637	7	2269.14	7	0
Heilongjiang	0.625	8	2188.21	8	0
Jilin	0.612	9	1883.93	12	3
Shandong	0.608	10	1958.39	9	-1
Shanxi	0.601	11	1648.71	16	5
Fujian	0.593	12	1929.25	11	-1
Hainan	0.592	13	1714.53	13	0
Hebei	0.584	14	1580.74	18	4
Xinjiang	0.573	15	1941.12	10	-5
Hubei	0.570	16	1678.92	15	-1
Inner Mongolia	0.560	17	1594.76	17	0
Hunan	0.556	18	1325.01	22	4
Guangxi	0.554	19	1150.21	29	10
Henan	0.549	20	1177.19	28	8
Shaanxi	0.544	21	1342.28	21	0
Ningxia	0.535	22	1503.05	19	-3
Sichuan	0.530	23	1192.30	26	3
Anhui	0.527	24	1275.38	24	0
Jiangxi	0.527	25	1217.11	25	0
Gansu	0.499	26	1185.82	27	1
Qinghai	0.494	27	1681.08	14	-13
Yunnan	0.490	28	1320.70	23	-5
Guizhou	0.466	29	873.99	30	1
Tibet	0.387	30	1376.80	20	-10

Source: Data from UNDP China Human Development Report, 1997

Note: Regions of China consist of provinces, autonomous regions and municipalities under direct control of the central government. Taiwan and the special administrative regions of Hong Kong and Macau are excluded. Values for 1995 do not include Chongqing as it became a municipality under direct control only in 1997. GDP per capita is in PPP-adjusted US$.

Table 4.5 Comparison of Rankings of the HDI and GDP, Provinces, China, 1995

Provinces	HDI	HDI Rank	GDP per capita	GDP Rank	Ranking Difference Between GDP and HDI
Shanghai	0.885	1	10901.10	1	0
Beijing	0.876	2	7750.10	2	0
Tianjin	0.859	3	6437.60	3	0
Guangdong	0.814	4	5149.60	4	0
Zhejiang	0.785	5	4932.40	5	0
Jiangsu	0.760	6	4402.90	6	0
Liaoning	0.756	7	4305.20	8	1
Fujian	0.729	8	4312.90	7	-1
Shandong	0.704	9	3684.60	9	0
Heilongjiang	0.676	10	3227.10	10	0
Hainan	0.674	11	2999.80	11	0
Hebei	0.670	12	2853.90	12	0
Jilin	0.659	13	2776.10	13	0
Shanxi	0.627	14	2189.80	17	3
Xinjiang	0.619	15	2702.20	14	-1
Henan	0.618	16	2228.30	16	0
Hubei	0.609	17	2404.90	15	-2
Guangxi	0.605	18	2071.50	18	0
Anhui	0.600	19	2047.80	19	0
Hunan	0.592	20	2003.30	22	2
Sichuan	0.582	21	1930.90	23	2
Inner Mongolia	0.578	22	1856.40	24	2
Jiangxi	0.577	23	1926.40	25	2
Ningxia	0.571	24	2021.10	21	-3
Shaanxi	0.570	25	1636.10	27	2
Yunnan	0.526	26	1813.70	26	0
Gansu	0.514	27	1381.70	29	2
Qinghai	0.503	28	2034.60	20	-8
Guizhou	0.494	29	1121.60	30	1
Tibet	0.391	30	1442.50	28	-2

Source: Data from UNDP China Human Development Report, 1997

Note: See note for table 4.4

Table 4.6 Comparison of Rankings of the HDI and GDP, Provinces, China, 1997

Region	HDI	HDI Rank	GDP per capita	GDP Rank	Ranking Difference Between GDP and HDI
Shanghai	0.877	1	14470.96	1	0
Beijing	0.867	2	9404.72	2	0
Tianjin	0.852	3	7753.06	3	0
Guangdong	0.843	4	5860.32	4	0
Liaoning	0.831	5	4790.87	8	3
Zhejiang	0.821	6	5909.21	4	-2
Jiangsu	0.817	7	5251.13	6	-1
Fujian	0.802	8	5202.80	7	-1
Shandong	0.770	9	4265.42	9	0
Heilongjiang	0.766	10	4070.42	10	0
Hebei	0.730	11	3416.27	11	0
Jilin	0.710	12	3093.13	15	3
Hainan	0.709	13	3202.16	14	1
Hubei	0.707	14	3315.12	13	-1
Xinjiang	0.685	15	3317.93	12	-3
Shanxi	0.679	16	2661.53	16	0
Hunan	0.662	17	2609.27	18	1
Henan	0.661	18	2489.57	20	2
Guangxi	0.649	19	2447.98	22	3
Anhui	0.646	20	2467.09	21	1
Inner Mongolia	0.645	21	2636.24	17	-4
Chongqing	0.635	22	2501.93	19	-3
Jiangxi	0.635	23	2335.02	23	0
Shaanxi	0.617	25	2083.26	28	3
Sichuan	0.617	24	2264.21	26	2
Ningxia	0.603	26	2261.97	27	1
Yunnan	0.583	27	2271.52	25	-2
Gansu	0.570	28	1762.93	30	2
Qinghai	0.528	29	2285.01	24	-5
Guizhou	0.516	30	1244.78	31	1
Tibet	0.452	31	1794.96	29	-2

Source: Data from UNDP China Human Development Report, 1999

Note: See note for table 4.4

Table 4.7 Comparison of Rankings of the HDI and GDP, Provinces, China, 1999

Provinces	HDI	HDI Rank	GDP per capita	GDP Rank	Ranking Difference Between GDP and HDI
Shanghai	0.853	1	14756.77	1	0
Beijing	0.845	2	9507.21	2	0
Tianjin	0.801	3	7653.33	3	0
Guangdong	0.771	4	5618.35	5	1
Liaoning	0.764	5	4831.76	8	3
Zhejiang	0.758	6	5766.02	4	-2
Jiangsu	0.750	7	5109.01	7	0
Fujian	0.733	8	5172.16	6	-2
Heilongjiang	0.732	9	3669.48	10	1
Shandong	0.724	10	4154.96	9	-1
Hebei	0.723	11	3320.70	11	0
Jilin	0.720	12	3037.52	15	3
Hainan	0.711	13	3057.72	14	1
Shanxi	0.710	14	2264.21	20	6
Xinjiang	0.707	15	3099.27	13	-2
Hubei	0.697	16	3120.47	12	-4
Henan	0.686	17	2344.29	18	1
Chongqing	0.684	18	2311.94	19	1
Hunan	0.683	19	2445.38	17	-2
Shaanxi	0.680	20	1964.79	29	9
Guangxi	0.680	21	1987.04	28	7
Inner Mongolia	0.679	22	2562.95	16	-6
Anhui	0.675	23	2254.96	21	-2
Jiangxi	0.673	24	2232.98	23	-1
Sichuan	0.671	25	2132.65	26	1
Ningxia	0.660	26	2142.57	24	-2
Yunnan	0.632	27	2132.81	25	-2
Gansu	0.632	28	1757.02	30	2
Qinghai	0.625	29	2233.50	22	-7
Guizhou	0.602	30	1185.77	31	1
Tibet	0.521	31	2041.55	27	-4

Source: Data from UNDP China Human Development Report, 2002

Note: See note for table 4.4

Table 4.8 Comparison of Rankings of the HDI and GDP, Provinces, China, 2003

Provinces	HDI	HDI Rank	GDP per capita	GDP Rank	Ranking Difference Between GDP and HDI
Shanghai	0.909	1	22141.73	1	0
Beijin	0.882	2	15195.13	2	0
Tianjin	0.855	3	12574.69	3	0
Zhejiang	0.817	4	9548.55	4	0
Liaoning	0.808	5	6757.50	8	3
Guangdong	0.807	6	8158.00	5	-1
Jiangsu	0.805	7	7966.53	6	-1
Heilongjiang	0.786	8	5504.86	10	2
Fujian	0.784	9	7099.21	7	-2
Shandong	0.776	10	6474.55	9	-1
Jilin	0.776	10	4425.69	13	3
Hebei	0.766	12	4982.58	11	-1
Hainan	0.761	13	3941.32	16	3
Xinjiang	0.757	14	4597.26	12	-2
Hubei	0.755	15	4270.71	14	-1
Shanxi	0.753	16	3523.78	19	3
Hunan	0.751	17	3580.17	18	1
Chongqing	0.745	18	3416.66	21	3
Henan	0.741	19	3587.76	17	-2
Inner Mongolia	0.738	20	4253.65	15	-5
Jiangxi	0.732	21	3165.00	24	3
Guangxi	0.731	22	2828.97	28	6
Shaanxi	0.729	23	3071.16	25	2
Sichuan	0.728	24	3041.77	27	3
Anhui	0.727	25	3059.31	26	1
Ningxia	0.712	26	3171.16	23	-3
Qinghai	0.684	27	3448.89	20	-7
Gansu	0.675	28	2380.15	30	2
Yunnan	0.657	29	2683.47	29	0
Guizhou	0.639	30	1707.62	31	1
Tibet	0.586	31	3256.47	22	-9

Source: Data from UNDP China Human Development Report, 2005

Note: See note for table 4.4

Table 4.9 Comparison of Rankings of the HDI and GDP, Provinces, China, 2006

Provinces	HDI	HDI Rank	GDP per capita	GDP Rank	Ranking Difference Between GDP and HDI
Shanghai	0.917	1	27477.22	1	0
Beijing	0.897	2	24034.89	2	0
Tianjin	0.881	3	19603.87	3	0
Zhejiang	0.840	4	15179.98	4	0
Jiangsu	0.830	5	13722.66	5	0
Guangdong	0.828	6	13493.11	6	0
Liaoning	0.822	7	10376.53	8	1
Shandong	0.815	8	11331.88	7	-1
Hebei	0.797	9	8078.15	11	2
Heilongjiang	0.796	10	7712.86	12	2
Jilin	0.795	11	7486.64	13	2
Fujian	0.795	12	10225.56	9	-3
Shanxi	0.782	13	6726.07	15	2
Inner Mongolia	0.779	14	9550.23	10	-4
Henan	0.768	15	6340.31	16	1
Hainan	0.767	17	6026.46	18	1
Hubei	0.767	16	6332.22	17	1
Chongqing	0.764	18	5932.64	19	1
Hunan	0.762	19	5691.18	21	2
Shaanxi	0.756	20	5780.72	20	0
Guangxi	0.755	21	4903.47	27	6
Xinjiang	0.752	22	7143.75	14	-8
Jiangxi	0.744	23	5142.54	24	1
Sichuan	0.742	24	5022.53	25	1
Anhui	0.737	25	4788.69	28	3
Ningxia	0.737	26	5642.13	22	-4
Qinghai	0.702	27	5601.65	23	-4
Gansu	0.687	28	4170.52	30	2
Yunnan	0.686	29	4271.96	29	0
Guizhou	0.659	30	2756.06	31	1
Tibet	0.621	31	4967.28	26	-5

Source: Data from UNDP China Human Development Report, 2007/2008

Note: See note for table 4.4

Table 4.10 Comparison of Rankings of the HDI and GDP, Provinces, China, 2008

Provinces	HDI	HDI Rank	GDP per capita	GDP Rank	Ranking Difference Between GDP and HDI
Shanghai	0.908	1	19373.62	1	0
Beijing	0.891	2	16678.59	2	0
Tianjin	0.875	3	14706.73	3	0
Guangdong	0.844	4	9962.82	6	2
Zhejiang	0.841	5	11164.04	4	-1
Jiangsu	0.837	6	10451.98	5	-1
Liaoning	0.835	7	8274.05	9	2
Shandong	0.828	8	8732.46	7	-1
Jilin	0.815	9	6206.11	11	2
Hebei	0.810	10	6132.18	12	2
Heilongjiang	0.808	11	5741.07	13	2
Fujian	0.807	12	7981.89	10	-2
Inner Mongolia	0.803	13	8525.67	8	-5
Shanxi	0.800	14	5407.19	14	0
Henan	0.787	15	5185.10	17	2
Hainan	0.784	17	4544.77	23	6
Hubei	0.784	16	5247.61	15	-1
Chongqing	0.783	18	4767.92	19	1
Hunan	0.781	19	4627.20	21	2
Guangxi	0.776	20	3959.72	25	5
Xinjiang	0.774	21	5247.61	16	-5
Shaanxi	0.773	22	4825.39	18	-4
Ningxia	0.766	23	4739.44	20	-3
Sichuan	0.763	24	4055.77	24	0
Jiangxi	0.760	25	3912.56	26	1
Anhui	0.750	26	3819.90	27	1
Qinghai	0.720	27	4599.56	22	-5
Yunnan	0.710	28	3328.17	29	1
Gansu	0.705	29	3210.65	30	1
Guizhou	0.690	30	2337.13	31	1
Tibet	0.630	31	3663.01	28	-3

Source: Data from UNDP China Human Development Report, 2009/2010

Note: See note for table 4.4

Table 4.11 Comparison of Rankings of the HDI and Life Expectancy, provinces, China, 1990

Provinces	HDI	HDI Rank	Life Expectancy at Birth	Life Expectancy Rank	Ranking Difference Between Life Expectancy and HDI
Shanghai	0.861	1	74.90	1	0
Tianjin	0.788	2	72.32	3	1
Beijing	0.769	3	72.86	2	-1
Liaoning	0.701	4	70.22	5	1
Guangdong	0.681	5	72.52	4	-1
Zhejiang	0.640	6	71.78	6	0
Jiangsu	0.637	7	71.37	7	0
Heilongjiang	0.625	8	66.97	10	2
Jilin	0.612	9	67.95	12	3
Shandong	0.608	10	70.57	9	-1
Shanxi	0.601	11	68.97	16	5
Fujian	0.593	12	68.57	8	-4
Hainan	0.592	13	70.01	13	0
Hebei	0.584	14	70.35	11	-3
Xinjiang	0.573	15	62.59	15	0
Hubei	0.570	16	67.25	14	-2
Inner Mongolia	0.560	17	65.68	21	4
Hunan	0.556	18	66.93	17	-1
Guangxi	0.554	19	68.72	19	0
Henan	0.549	20	70.15	18	-2
Shaanxi	0.544	21	67.40	24	3
Ningxia	0.535	22	66.94	25	3
Sichuan	0.530	23	66.33	23	0
Anhui	0.527	24	69.48	20	-4
Jiangxi	0.527	25	66.11	22	-3
Gansu	0.499	26	67.24	27	1
Qinghai	0.494	27	60.57	28	1
Yunnan	0.490	28	63.49	26	-2
Guizhou	0.466	29	64.29	29	0
Tibet	0.387	30	59.64	30	0

Source: Data from UNDP China Human Development Report,1997

Note: See note for table 4.4

Table 4.12 Comparison of Rankings of the HDI and Life Expectancy, provinces, China, 1995

Provinces	HDI	HDI Rank	Life Expectancy at Birth	Life Expectancy Rank	Ranking Difference Between Life Expectancy and HDI
Shanghai	0.885	1	75.20	1	0
Beijing	0.876	2	73.60	2	0
Tianjin	0.859	3	72.70	4	1
Guangdong	0.814	4	73.00	3	-1
Zhejiang	0.785	5	72.40	5	0
Jiangsu	0.760	6	72.20	6	0
Liaoning	0.756	7	70.80	10	3
Fujian	0.729	8	70.20	11	3
Shandong	0.704	9	71.20	9	0
Heilongjiang	0.676	10	68.20	19	9
Hainan	0.674	11	72.20	7	-4
Hebei	0.670	12	71.80	8	-4
Jilin	0.659	13	68.40	16	3
Shanxi	0.627	14	69.60	14	0
Xinjiang	0.619	15	65.00	27	12
Henan	0.618	16	70.20	12	-4
Hubei	0.609	17	67.50	21	4
Guangxi	0.605	18	69.20	15	-3
Anhui	0.600	19	69.80	13	-6
Hunan	0.592	20	67.30	22	2
Sichuan	0.582	21	67.10	23	2
Inner Mongolia	0.578	22	66.90	24	2
Jiangxi	0.577	23	66.70	25	2
Ningxia	0.571	24	68.30	18	-6
Shaanxi	0.570	25	68.40	17	-8
Yunnan	0.526	26	63.90	28	2
Gansu	0.514	27	67.60	20	-7
Qinghai	0.503	28	61.80	29	1
Guizhou	0.494	29	65.10	26	-3
Tibet	0.391	30	59.80	30	0

Source: Data from UNDP China Human Development Report, 1997

Note: See note for table 4.4

Table 4.13 Comparison of Rankings of the HDI and Life Expectancy, Provinces, China, 1997

Provinces	HDI	HDI Rank	Life Expectancy at Birth	Life Expectancy Rank	Ranking Difference Between Life Expectancy and HDI
Shanghai	0.877	1	74.90	1	0
Beijing	0.867	2	72.86	2	0
Tianjin	0.852	3	72.32	4	1
Guangdong	0.843	4	72.52	3	-1
Liaoning	0.831	5	70.22	9	4
Zhejiang	0.821	6	71.78	5	-1
Jiangsu	0.817	7	71.37	6	-1
Fujian	0.802	8	68.57	15	7
Shandong	0.770	9	70.57	7	-2
Heilongjiang	0.766	10	66.97	20	10
Hebei	0.730	11	70.35	8	-3
Jilin	0.710	12	67.95	16	4
Hainan	0.709	13	70.01	11	-2
Hubei	0.707	14	67.25	18	4
Xinjiang	0.685	15	62.59	29	14
Shanxi	0.679	16	68.97	13	-3
Hunan	0.662	17	66.93	22	5
Henan	0.661	18	70.15	10	-8
Guangxi	0.649	19	68.72	14	-5
Anhui	0.646	20	69.48	12	-8
Inner Mongolia	0.645	21	65.68	26	5
Chongqing	0.635	22	66.33	23	1
Jiangxi	0.635	23	66.11	25	2
Shaanxi	0.617	25	67.40	17	-8
Sichuan	0.617	24	66.33	24	0
Ningxia	0.603	26	66.94	21	-5
Yunnan	0.583	27	63.49	28	1
Gansu	0.570	28	67.24	19	-9
Qinghai	0.528	29	60.57	30	1
Guizhou	0.516	30	64.29	27	-3
Tibet	0.452	31	59.64	31	0

Source: Data from UNDP China Human Development report,1999

Note: See note for table 4.4

Table 4.14 Comparison of Rankings of the HDI and Life Expectancy, Provinces, China, 1999

Provinces	HDI	HDI Rank	Life Expectancy at Birth	Life Expectancy Rank	Ranking Difference Between Life Expectancy and HDI
Shanghai	0.853	1	75.47	2	1
Beijing	0.845	2	76.41	1	-1
Tianjin	0.801	3	73.80	4	1
Guangdong	0.771	4	74.17	3	-1
Liaoning	0.764	5	72.27	10	5
Zhejiang	0.758	6	73.79	5	-1
Jiangsu	0.750	7	73.40	7	0
Fujian	0.733	8	71.74	12	4
Heilongjiang	0.732	9	70.96	15	6
Shandong	0.724	10	73.56	6	-4
Hebei	0.723	11	71.89	11	0
Jilin	0.720	12	69.49	19	7
Hainan	0.711	13	72.35	8	-5
Shanxi	0.710	14	72.30	9	-5
Xinjiang	0.707	15	69.10	20	5
Hubei	0.697	16	68.67	27	11
Henan	0.686	17	71.03	14	-3
Chongqing	0.684	18	68.90	21	3
Hunan	0.683	19	67.23	26	7
Shaanxi	0.680	20	70.60	16	-4
Guangxi	0.680	21	70.24	18	-3
Inner Mongolia	0.679	22	68.49	23	1
Anhui	0.675	23	71.04	13	-10
Jiangxi	0.673	24	67.58	24	0
Sichuan	0.671	25	68.90	22	-3
Ningxia	0.660	26	70.30	17	-9
Yunnan	0.632	27	65.52	30	3
Gansu	0.632	28	67.58	25	-3
Qinghai	0.625	29	66.56	28	-1
Guizhou	0.602	30	66.23	29	-1
Tibet	0.521	31	63.53	31	0

Source: Data from UNDP China Human Development Report, 2002

Note: See note for table 4.4

Table 4.15 Comparison of Rankings of the HDI and Life Expectancy, Provinces, China, 2003

Provinces	HDI	HDI Rank	Life Expectancy at Birth	Life Expectancy Rank	Ranking Difference Between Life Expectancy and HDI
Shanghai	0.909	1	79.05	1	0
Beijin	0.882	2	76.85	2	0
Tianjin	0.855	3	75.96	3	0
Zhejiang	0.817	4	75.10	6	2
Liaoning	0.808	5	74.35	8	3
Guangdong	0.807	6	74.96	7	1
Jiangsu	0.805	7	75.58	5	-2
Heilongjiang	0.786	8	74.28	9	1
Fujian	0.784	9	74.26	10	1
Shandong	0.776	10	74.02	11	1
Jilin	0.776	10	73.26	13	3
Hebei	0.766	12	72.63	17	5
Hainan	0.761	13	75.75	4	-9
Xinjiang	0.757	14	72.26	19	5
Hubei	0.755	15	72.72	16	1
Shanxi	0.753	16	72.15	20	4
Hunan	0.751	17	72.63	17	0
Chongqing	0.745	18	71.96	21	3
Henan	0.741	19	73.00	14	-5
Inner Mongolia	0.738	20	70.73	25	5
Jiangxi	0.732	21	70.19	26	5
Guangxi	0.731	22	73.59	12	-10
Shaanxi	0.729	23	71.11	24	1
Sichuan	0.728	24	71.94	23	-1
Anhui	0.727	25	72.97	15	-10
Ningxia	0.712	26	71.96	21	-5
Qinghai	0.684	27	68.78	28	1
Gansu	0.675	28	68.82	27	-1
Yunnan	0.657	29	66.37	30	1
Guizhou	0.639	30	66.62	29	-1
Tibet	0.586	31	65.81	31	0

Source: Data from UNDP China Human Development Report, 2005

Note: See note for table 4.4

Table 4.16 Comparison of Rankings of the HDI and Life Expectancy, Provinces, China, 2006

Provinces	HDI	HDI Rank	Life Expectancy at Birth	Life Expectancy Rank	Ranking Difference Between Life Expectancy and HDI
Shanghai	0.917	1	78.14	1	0
Beijing	0.897	2	76.10	2	0
Tianjin	0.881	3	74.91	3	0
Zhejiang	0.840	4	74.70	4	0
Jiangsu	0.830	5	73.91	6	1
Guangdong	0.828	6	73.27	8	2
Liaoning	0.822	7	73.34	7	0
Shandong	0.815	8	73.92	5	-3
Hebei	0.797	9	72.54	12	3
Heilongjiang	0.796	10	72.37	13	3
Jilin	0.795	11	73.10	9	-2
Fujian	0.795	12	72.55	11	-1
Shanxi	0.782	13	71.65	16	3
Inner Mongolia	0.779	14	69.87	24	10
Henan	0.768	15	71.54	17	2
Hainan	0.767	17	72.92	10	-7
Hubei	0.767	16	71.08	20	4
Chongqing	0.764	18	71.73	15	-3
Hunan	0.762	19	70.66	21	2
Shaanxi	0.756	20	70.07	23	3
Guangxi	0.755	21	71.29	18	-3
Xinjiang	0.752	22	67.41	27	5
Jiangxi	0.744	23	68.95	25	2
Sichuan	0.742	24	71.20	19	-5
Anhui	0.737	25	71.85	14	-11
Ningxia	0.737	26	70.17	22	-4
Qinghai	0.702	27	66.03	28	1
Gansu	0.687	28	67.47	26	-2
Yunnan	0.686	29	65.49	30	1
Guizhou	0.659	30	65.96	29	-1
Tibet	0.621	31	64.37	31	0

Source: Data from UNDP China Human Development Report, 2007/2008

Note: See note for table 4.4

Table 4.17 Comparison of Rankings of the HDI and Life Expectancy, Provinces, China, 2008

Provinces	HDI	HDI Rank	Life Expectancy at Birth	Life Expectancy Rank	Ranking Difference Between Life Expectancy and HDI
Shanghai	0.908	1	78.16	1	0
Beijing	0.891	2	76.12	2	0
Tianjin	0.875	3	74.92	3	0
Guangdong	0.844	4	73.3	8	4
Zhejiang	0.841	5	74.68	4	-1
Jiangsu	0.837	6	73.9	5	-1
Liaoning	0.835	7	73.36	7	0
Shandong	0.828	8	73.9	6	-2
Jilin	0.815	9	73.12	9	0
Hebei	0.810	10	72.52	12	2
Heilongjiang	0.808	11	72.4	13	2
Fujian	0.807	12	72.58	11	-1
Inner Mongolia	0.803	13	69.88	24	11
Shanxi	0.800	14	71.68	16	2
Henan	0.787	15	71.56	17	2
Hainan	0.784	17	72.94	10	-7
Hubei	0.784	16	71.08	20	4
Chongqing	0.783	18	71.74	15	-3
Hunan	0.781	19	70.66	21	2
Guangxi	0.776	20	71.32	18	-2
Xinjiang	0.774	21	67.42	27	6
Shaanxi	0.773	22	70.06	23	1
Ningxia	0.766	23	70.18	22	-1
Sichuan	0.763	24	71.2	19	-5
Jiangxi	0.760	25	68.98	25	0
Anhui	0.750	26	71.86	14	-12
Qinghai	0.720	27	66.04	28	1
Yunnan	0.710	28	65.5	30	2
Gansu	0.705	29	67.48	26	-3
Guizhou	0.690	30	65.98	29	-1
Tibet	0.630	31	64.36	31	0

Source: Data from UNDP China Human Development Report, 2009/2010

Note: See note for table 4.4

Table 6.1 Administrative Division, Liaoning Province, China, 2000

Prefectures	City Districts,Counties and County-Level Cities
Shenyang	1. Heping District
	2. Shenhe District
	3. Dadong District
	4. Huanggu District
	5. Tiexi District
	6. Sujiatun District
	7. Dongling District
	8. Shenbei New District
	9. Xinmin Couty-level city
	10.Liaozhong County
	11.Kangping County
	12.Faku County
Dalian	1. Zhongshan District
	2. Xigang District
	3. Shahekou District
	4. Ganjingzi District
	5. Lushunkou District
	6. Jinzhou District
	7. Wafangdian County-level City
	8. Pulandian County-level City
	9. Zhuanghe County-level City
	10.Changhai County
Anshan	1. Tiedong District
	2. Tiexi District
	3. Lishan District
	4. Qianshan District
	5. Haicheng County-level City
	6. Taian County
	7. Xiuyan Manchu Autonomous County
Fushun	1. Xinfu District
	2. Dongzhou District
	3. Wanghua District
	4. Shuncheng District
	5. Fushun County
	6. Qingyuan Manchu Autonomous County
	7. Xinbin Manchu Autonomous County
Benxi	1. Pingshan District
	2. Xihu District
	3. Mingshan District
	4. Nanfen District
	5. Benxi Manchu Autonomous County
	6. Huanren Manchu Autonomous County
Dandong	1. Yuanbao Distric
	2. Zhenxing District
	3. Zhenan District
	4. Donggang County-level City
	5. Fengcheng County-level City
	6. Kuandian Manchu Autonomous County
Jinzhou	1. Guta District
	2. Linghe District
	3. Taihe District
	4. Linghai County-level City
	5. Beizhen County-level City
	6. Heishan County
	7. Yi County

Table 6.1 continued

Prefectures	City Districts,Counties and County-Level Cities
Yingkou	1. Zhanqian District
	2. Xishi District
	3. Bayuquan District
	4. Laobian District
	5. Gaizhou County-level City
	6. Dashiqiao County-level City
Fuxin	1. Haizhou District
	2. Xinqiu District
	3. Taiping District
	4. Qinghemen District
	5. Xihe District
	6. Fuxin Mongolian Autonomous County
	7. Zhangwu County
Liaoyang	1. Baita District
	2. Wensheng District
	3. Hongwei District
	4. Gongchangling District
	5. Taizihe District
	6. Dengta County-level City
	7. Liaoyang County
Panjin	1. Shuangtaizi District
	2. Xinglong District
	3. Dawa County
	4. Panshan County
Tieling	1. Yinzhou District
	2. Qinghe District
	3. Diaobingshan County-level City
	4. Kaiyuan County-level City
	5. Tieling County
	6. Xifeng County
	7. Changtu County
Chaoyang	1. Shuangta District
	2. Longcheng District
	3. Beipiao County-level City
	4. Lingyuan County-level City
	5. Chaoyang County
	6. Jianping County
	7. Kalaqin Left Wing Mongolian Autonomous County
Huludao	1. Lianshan District
	2. Longgang District
	3. Nanpiao District
	4. Xingcheng County-level City
	5. Suizhong County
	6. Jianchang County

Source: Population Census Office, Liaoning Province, 2002

Table 6.2 Official Administrative Organizations and Grassroots Organizations of Liaoning Province

Administrative Organizations		Liaoning Province	
	level 1	Prefecture-level city	
		Urban Core	Rural
	level 2	City District	County, County-level City, Automous County
	level 3	Street, town and township	Town and township
Grassroots Organizations	**level 4**	Street: Residential Committee	Town: Residential Committee and Village Committee
		Town: Residential Committee and Village Committee	Township: Village Committee
		Township: Village Committee	

Source: Mok, 1988 and Shen, 1995

Table 6.3 Abridged Life-table for 5-year Age Intervals, Shenyang Prefecture, Liaoning Province, 2000

Age groups	population	deaths	M_x	q_x	l_x	d_x	L_x	T_x	e_x
0	54961	606	0.0110	0.0109	100000	1092	99017	7406026	74.06
1-4	202215	403	0.0020	0.0079	98908	785	394062	7307009	73.88
5-9	330925	111	0.0003	0.0017	98123	164	490203	6912946	70.45
10-14	507219	153	0.0003	0.0015	97958	148	489423	6422743	65.57
15-19	559415	237	0.0004	0.0021	97811	207	488537	5933320	60.66
20-24	579633	360	0.0006	0.0031	97604	303	487263	5444783	55.78
25-29	575774	436	0.0008	0.0038	97301	368	485587	4957520	50.95
30-34	673174	670	0.0010	0.0050	96934	481	483465	4471933	46.13
35-39	763813	1195	0.0016	0.0078	96452	752	480383	3988469	41.35
40-44	714039	1591	0.0022	0.0111	95701	1060	475853	3508086	36.66
45-49	652964	2005	0.0031	0.0152	94640	1442	469598	3032233	32.04
50-54	403683	1952	0.0048	0.0239	93199	2226	460427	2562635	27.50
55-59	282954	2393	0.0085	0.0414	90972	3767	445443	2102208	23.11
60-64	279932	3961	0.0141	0.0683	87205	5959	421128	1656765	19.00
65-69	258464	6448	0.0249	0.1174	81246	9539	382382	1235638	15.21
70-74	189056	7799	0.0413	0.1870	71707	13408	325014	853256	11.90
75-79	106229	7171	0.0675	0.2888	58299	16836	249405	528242	9.06
80-84	45823	5219	0.1139	0.4433	41463	18379	161367	278837	6.72
85+	23444	4607	0.1965	1.0000	23084	23084	117470	117470	5.09
Total	7203717	47317					7406026		

Source: Data from Table A01-07, Table A06-01, Population Census Office，Liaoning Province, 2002

Table 6.4 Abridged Life-table for 5-year Age Intervals, Dalian Prefecture, Liaoning Province, 2000

Age groups	population	deaths	Mx	qx	lx	dx	Lx	Tx	ex
0	42028	450	0.0107	0.0106	100000	1060	99046	7685747	76.86
1-4	183285	108	0.0006	0.0024	98940	233	395292	7586701	76.68
5-9	273996	89	0.0003	0.0016	98707	160	493132	7191409	72.86
10-14	444813	137	0.0003	0.0015	98546	152	492353	6698277	67.97
15-19	422190	166	0.0004	0.0020	98395	193	491491	6205924	63.07
20-24	434567	296	0.0007	0.0034	98202	334	490173	5714433	58.19
25-29	539762	425	0.0008	0.0039	97868	385	488377	5224260	53.38
30-34	557014	531	0.0010	0.0048	97483	464	486257	4735884	48.58
35-39	576815	756	0.0013	0.0065	97020	634	483513	4249627	43.80
40-44	561302	1125	0.0020	0.0100	96386	961	479526	3766114	39.07
45-49	511940	1387	0.0027	0.0135	95425	1284	473914	3286587	34.44
50-54	348247	1452	0.0042	0.0206	94141	1942	465848	2812673	29.88
55-59	253666	1647	0.0065	0.0319	92198	2945	453629	2346825	25.45
60-64	230040	2480	0.0108	0.0525	89253	4685	434554	1893197	21.21
65-69	198826	3646	0.0183	0.0877	84568	7414	404306	1458643	17.25
70-74	146307	4557	0.0311	0.1445	77154	11148	357903	1054337	13.67
75-79	92851	4916	0.0529	0.2338	66007	15431	291456	696434	10.55
80-84	47881	4201	0.0877	0.3598	50576	18196	207388	404978	8.01
85+	28162	4615	0.1639	1.0000	32380	32380	197590	197590	6.10
Total	5893692	32984					7685747		

Source: Data from Table A01-07, Table A06-01, Population Census Office，Liaoning Province, 2002

Table 6.5 Abridged Life-table for 5-year Age Intervals, Anshan Prefecture, Liaoning Province, 2000

Age groups	population	deaths	M_x	q_x	l_x	d_x	L_x	T_x	e_x
0	32118	160	0.0050	0.0050	100000	496	99554	7542234	75.42
1-4	118848	55	0.0005	0.0018	99504	184	397648	7442680	74.80
5-9	193970	58	0.0003	0.0015	99320	148	496229	7045032	70.93
10-14	280828	89	0.0003	0.0016	99172	157	495466	6548803	66.04
15-19	254397	124	0.0005	0.0024	99015	241	494471	6053337	61.14
20-24	258426	202	0.0008	0.0039	98774	385	492905	5558867	56.28
25-29	291757	247	0.0008	0.0042	98388	416	490903	5065962	51.49
30-34	345186	372	0.0011	0.0054	97973	526	488547	4575059	46.70
35-39	380572	517	0.0014	0.0068	97446	660	485582	4086512	41.94
40-44	341440	728	0.0021	0.0106	96787	1026	481367	3600929	37.20
45-49	310057	884	0.0029	0.0142	95760	1355	475413	3119562	32.58
50-54	198440	857	0.0043	0.0214	94405	2017	466982	2644150	28.01
55-59	148364	1225	0.0083	0.0404	92388	3737	452598	2177168	23.57
60-64	141445	1838	0.0130	0.0629	88651	5579	429309	1724570	19.45
65-69	116989	2837	0.0243	0.1143	83072	9497	391620	1295261	15.59
70-74	87003	3486	0.0401	0.1821	73576	13398	334383	903641	12.28
75-79	49190	3045	0.0619	0.2680	60178	16130	260564	569258	9.46
80-84	22417	2428	0.1083	0.4262	44048	18771	173311	308693	7.01
85+	12592	2351	0.1867	1.0000	25277	25277	135382	135382	5.36
Total	3584039	21503					7542234		

Source: Data from Table A01-07, Table A06-01, Population Census Office，Liaoning Province, 2002

Table 6.6 Abridged Life-table for 5-year Age Intervals, Shenyang Prefecture, Liaoning Province, 2000

Age groups	population	deaths	Mx	qx	lx	dx	Lx	Tx	ex
0	15824	195	0.0123	0.0122	100000	1219	98903	7335244	73.35
1-4	63221	49	0.0008	0.0031	98781	306	394513	7236341	73.26
5-9	110763	42	0.0004	0.0019	98475	187	491911	6841828	69.48
10-14	177604	53	0.0003	0.0015	98289	147	491078	6349917	64.60
15-19	156903	75	0.0005	0.0024	98142	234	490126	5858839	59.70
20-24	145193	128	0.0009	0.0044	97908	431	488464	5368712	54.83
25-29	178504	187	0.0010	0.0052	97477	509	486114	4880248	50.07
30-34	217521	331	0.0015	0.0076	96968	735	483004	4394134	45.32
35-39	263515	498	0.0019	0.0094	96233	905	478904	3911131	40.64
40-44	237696	627	0.0026	0.0131	95328	1249	473518	3432227	36.00
45-49	200469	710	0.0035	0.0176	94079	1651	466267	2958709	31.45
50-54	122977	684	0.0056	0.0274	92428	2535	455801	2492442	26.97
55-59	90124	857	0.0095	0.0464	89893	4175	439026	2036641	22.66
60-64	92618	1441	0.0156	0.0749	85718	6419	412543	1597615	18.64
65-69	78057	2211	0.0283	0.1323	79299	10488	370276	1185072	14.94
70-74	57021	2603	0.0456	0.2049	68811	14097	308812	814796	11.84
75-79	32107	2188	0.0681	0.2911	54714	15929	233746	505984	9.25
80-84	13505	1480	0.1096	0.4301	38785	16682	152219	272238	7.02
85+	6668	1228	0.1842	1.0000	22103	22103	120019	120019	5.43
Total	2260290	15587					7335244		

Source: Data from Table A01-07, Table A06-01, Population Census Office，Liaoning Province, 2002

Table 6.7 Abridged Life-table for 5-year Age Intervals, Benxi Prefecture, Liaoning Province, 2000

Age groups	population	deaths	Mx	qx	lx	dx	Lx	Tx	ex
0	11173	240	0.0215	0.0211	100000	2107	98103	7548975	75.49
1-4	45282	21	0.0005	0.0019	97893	181	391208	7450872	76.11
5-9	83484	26	0.0003	0.0016	97711	152	488176	7059664	72.25
10-14	133095	31	0.0002	0.0012	97559	114	487512	6571488	67.36
15-19	108316	39	0.0004	0.0018	97446	175	486790	6083976	62.43
20-24	102165	70	0.0007	0.0034	97270	333	485520	5597185	57.54
25-29	124614	105	0.0008	0.0042	96938	408	483670	5111665	52.73
30-34	155767	150	0.0010	0.0048	96530	464	481492	4627995	47.94
35-39	180758	244	0.0013	0.0067	96067	646	478717	4146503	43.16
40-44	158700	326	0.0021	0.0102	95420	975	474664	3667786	38.44
45-49	134908	385	0.0029	0.0142	94445	1338	468881	3193122	33.81
50-54	83468	381	0.0046	0.0226	93107	2101	460283	2724241	29.26
55-59	63868	505	0.0079	0.0388	91006	3528	446211	2263957	24.88
60-64	57694	770	0.0133	0.0646	87478	5649	423268	1817747	20.78
65-69	50464	1098	0.0218	0.1032	81829	8443	388038	1394479	17.04
70-74	38734	1339	0.0346	0.1591	73386	11675	337742	1006442	13.71
75-79	21104	1193	0.0565	0.2476	61711	15283	270347	668700	10.84
80-84	9104	801	0.0880	0.3606	46428	16742	190285	398353	8.58
85+	4710	672	0.1427	1.0000	29686	29686	208068	208068	7.01
Total	1567408	8396					7548975		

Source: Data from Table A01-07, Table A06-01, Population Census Office，Liaoning Province, 2002

Table 6.8 Abridged Life-table for 5-year Age Intervals, Dandong Prefecture, Liaoning Province, 2000

Age groups	population	deaths	Mx	qx	lx	dx	Lx	Tx	ex
0	18751	169	0.0090	0.0089	100000	894	99195	7497905	74.98
1-4	81572	47	0.0006	0.0023	99106	228	395968	7398710	74.65
5-9	129898	49	0.0004	0.0019	98878	186	493923	7002742	70.82
10-14	187418	59	0.0003	0.0016	98692	155	493069	6508819	65.95
15-19	160958	67	0.0004	0.0021	98536	205	492169	6015749	61.05
20-24	167084	128	0.0008	0.0038	98331	376	490717	5523580	56.17
25-29	204078	186	0.0009	0.0045	97955	445	488664	5032863	51.38
30-34	236322	311	0.0013	0.0066	97510	640	485952	4544199	46.60
35-39	245814	409	0.0017	0.0083	96871	803	482347	4058247	41.89
40-44	221699	462	0.0021	0.0104	96068	996	477851	3575901	37.22
45-49	215146	733	0.0034	0.0169	95072	1606	471347	3098050	32.59
50-54	143872	771	0.0054	0.0264	93466	2471	461154	2626703	28.10
55-59	101762	844	0.0083	0.0406	90995	3697	445733	2165550	23.80
60-64	83816	1119	0.0134	0.0646	87298	5639	422393	1719816	19.70
65-69	70628	1674	0.0237	0.1119	81659	9136	385455	1297423	15.89
70-74	57249	2206	0.0385	0.1757	72523	12745	330753	911968	12.57
75-79	36568	2323	0.0635	0.2741	59778	16385	257928	581215	9.72
80-84	18237	1823	0.1000	0.3999	43393	17352	173586	323288	7.45
85+	9652	1679	0.1740	1.0000	26041	26041	149702	149702	5.75
Total	2390524	15059					7497905		

Source: Data from Table A01-07, Table A06-01, Population Census Office，Liaoning Province, 2002

Table 6.9 Abridged Life-table for 5-year Age Intervals, Jinzhou Prefecture, Liaoning Province, 2000

Age groups	population	deaths	Mx	qx	lx	dx	Lx	Tx	ex
0	25333	328	0.0129	0.0128	100000	1280	98848	7443235	74.43
1-4	104004	61	0.0006	0.0023	98720	231	394418	7344387	74.40
5-9	168356	59	0.0004	0.0018	98489	172	492013	6949969	70.57
10-14	240221	80	0.0003	0.0017	98316	164	491173	6457956	65.69
15-19	217320	121	0.0006	0.0028	98153	273	490082	5966783	60.79
20-24	232023	192	0.0008	0.0041	97880	404	488389	5476701	55.95
25-29	247894	219	0.0009	0.0044	97476	430	486305	4988311	51.17
30-34	292892	319	0.0011	0.0054	97046	527	483913	4502006	46.39
35-39	303279	430	0.0014	0.0071	96519	682	480891	4018093	41.63
40-44	279899	611	0.0022	0.0109	95837	1040	476586	3537202	36.91
45-49	283852	852	0.0030	0.0149	94797	1412	470455	3060616	32.29
50-54	183113	892	0.0049	0.0241	93385	2247	461306	2590162	27.74
55-59	132341	1041	0.0079	0.0386	91138	3515	446900	2128855	23.36
60-64	111506	1495	0.0134	0.0649	87622	5683	423903	1681955	19.20
65-69	93132	2130	0.0229	0.1082	81939	8863	387537	1258052	15.35
70-74	76166	3049	0.0400	0.1819	73076	13296	332139	870515	11.91
75-79	49312	3333	0.0676	0.2891	59780	17282	255693	538376	9.01
80-84	23205	2595	0.1118	0.4370	42498	18571	166061	282683	6.65
85+	12887	2644	0.2052	1.0000	23927	23927	116621	116622	4.87
Total	3076735	20451					7443235		

Source: Data from Table A01-07, Table A06-01, Population Census Office，Liaoning Province, 2002

Table 6.10 Abridged Life-table for 5-year Age Intervals, Yingkou Prefecture, Liaoning Province, 2000

Age groups	population	deaths	M_x	q_x	l_x	d_x	L_x	T_x	e_x
0	20397	139	0.0068	0.0068	100000	677	99390	7561879	75.62
1-4	72800	73	0.0010	0.0040	99323	398	396496	7462489	75.13
5-9	114960	43	0.0004	0.0019	98925	185	494163	7065993	71.43
10-14	243236	95	0.0004	0.0020	98740	193	493220	6571830	66.56
15-19	170793	93	0.0005	0.0027	98548	268	492068	6078610	61.68
20-24	173957	143	0.0008	0.0041	98280	403	490391	5586542	56.84
25-29	201569	178	0.0009	0.0044	97877	431	488305	5096151	52.07
30-34	223461	274	0.0012	0.0061	97445	596	485738	4607846	47.29
35-39	224106	301	0.0013	0.0067	96850	648	482628	4122108	42.56
40-44	195967	390	0.0020	0.0099	96202	953	478626	3639480	37.83
45-49	190206	510	0.0027	0.0133	95249	1268	473074	3160854	33.19
50-54	125522	541	0.0043	0.0213	93981	2004	464894	2687780	28.60
55-59	94247	678	0.0072	0.0353	91977	3250	451760	2222886	24.17
60-64	83567	1022	0.0122	0.0593	88727	5265	430473	1771126	19.96
65-69	59632	1275	0.0214	0.1015	83462	8470	396137	1340653	16.06
70-74	46221	1730	0.0374	0.1711	74993	12834	342879	944516	12.59
75-79	30648	1809	0.0590	0.2572	62159	15986	270830	601637	9.68
80-84	15716	1614	0.1027	0.4086	46173	18866	183702	330807	7.16
85+	9535	1770	0.1856	1.0000	27307	27307	147105	147105	5.39
Total	2296540	12678					7561879		

Source: Data from Table A01-07, Table A06-01, Population Census Office，Liaoning Province, 2002

Table 6.11 Abridged Life-table for 5-year Age Intervals, Fuxin Prefecture, Liaoning Province, 2000

Age groups	population	deaths	M_x	q_x	l_x	d_x	L_x	T_x	e_x
0	15570	136	0.0087	0.0087	100000	867	99220	7350633	73.51
1-4	69051	36	0.0005	0.0021	99133	207	396120	7251413	73.15
5-9	118101	29	0.0002	0.0012	98927	121	494331	6855293	69.30
10-14	147923	40	0.0003	0.0014	98805	134	493693	6360962	64.38
15-19	128599	59	0.0005	0.0023	98672	226	492794	5867269	59.46
20-24	135786	119	0.0009	0.0044	98446	430	491153	5374475	54.59
25-29	162593	160	0.0010	0.0049	98015	481	488874	4883322	49.82
30-34	197484	250	0.0013	0.0063	97534	615	486133	4394448	45.06
35-39	201681	328	0.0016	0.0081	96919	785	482632	3908314	40.33
40-44	174335	463	0.0027	0.0132	96134	1268	477500	3425682	35.63
45-49	153051	586	0.0038	0.0190	94866	1799	469832	2948182	31.08
50-54	100644	615	0.0061	0.0301	93067	2801	458333	2478350	26.63
55-59	74140	749	0.0101	0.0493	90266	4447	440213	2020017	22.38
60-64	75880	1264	0.0167	0.0800	85819	6862	411940	1579804	18.41
65-69	58772	1698	0.0289	0.1347	78957	10638	368191	1167864	14.79
70-74	42253	1844	0.0436	0.1967	68319	13441	307994	799673	11.70
75-79	21473	1537	0.0716	0.3036	54878	16659	232742	491680	8.96
80-84	8279	965	0.1166	0.4513	38219	17248	147974	258938	6.78
85+	4159	786	0.1890	1.0000	20971	20971	110964	110964	5.29
Total	1889774	11664					7350633		

Source: Data from Table A01-07, Table A06-01, Population Census Office，Liaoning Province, 2002

Table 6.12 Abridged Life-table for 5-year Age Intervals, Liaoyang Prefecture, Liaoning Province, 2000

Age groups	population	deaths	Mx	qx	lx	dx	Lx	Tx	ex
0	16490	146	0.0089	0.0088	100000	878	99209	7503766	75.04
1-4	66672	95	0.0014	0.0057	99122	563	395360	7404557	74.70
5-9	93272	39	0.0004	0.0021	98558	206	492277	7009197	71.12
10-14	139395	32	0.0002	0.0011	98352	113	491480	6516920	66.26
15-19	118604	66	0.0006	0.0028	98240	273	490516	6025440	61.33
20-24	139759	96	0.0007	0.0034	97967	336	488994	5534924	56.50
25-29	169850	130	0.0008	0.0038	97631	373	487222	5045931	51.68
30-34	175423	158	0.0009	0.0045	97258	437	485197	4558709	46.87
35-39	178767	250	0.0014	0.0070	96821	675	482418	4073512	42.07
40-44	158379	362	0.0023	0.0114	96146	1093	478000	3591095	37.35
45-49	160025	517	0.0032	0.0160	95054	1523	471460	3113095	32.75
50-54	110399	506	0.0046	0.0227	93530	2119	462355	2641635	28.24
55-59	80310	612	0.0076	0.0374	91411	3418	448512	2179280	23.84
60-64	65532	846	0.0129	0.0625	87993	5502	426212	1730768	19.67
65-69	48520	1030	0.0212	0.1008	82491	8315	391670	1304557	15.81
70-74	36660	1412	0.0385	0.1757	74177	13030	338308	912887	12.31
75-79	23432	1494	0.0638	0.2750	61146	16813	263699	574579	9.40
80-84	12652	1360	0.1075	0.4236	44333	18781	174715	310880	7.01
85+	7066	1326	0.1877	1.0000	25553	25553	136165	136165	5.33
Total	1801207	10477					7503766		

Source: Data from Table A01-07, Table A06-01, Population Census Office，Liaoning Province, 2002

Table 6.13 Abridged Life-table for 5-year Age Intervals, Panjin Prefecture, Liaoning Province, 2000

Age groups	population	deaths	M_x	q_x	l_x	d_x	L_x	T_x	e_x
0	11701	103	0.0088	0.0087	100000	873	99214	7684597	76.85
1-4	50105	30	0.0006	0.0024	99127	237	396032	7585383	76.52
5-9	78072	28	0.0004	0.0018	98890	177	494005	7189351	72.70
10-14	99193	25	0.0003	0.0013	98712	124	493251	6695346	67.83
15-19	77414	29	0.0004	0.0019	98588	184	492479	6202095	62.91
20-24	98912	54	0.0005	0.0027	98404	268	491347	5709616	58.02
25-29	128712	90	0.0007	0.0035	98135	342	489820	5218269	53.17
30-34	142971	120	0.0008	0.0042	97793	410	487940	4728448	48.35
35-39	128348	149	0.0012	0.0058	97383	564	485507	4240508	43.54
40-44	104718	197	0.0019	0.0094	96820	906	481832	3755001	38.78
45-49	111270	314	0.0028	0.0140	95913	1344	476206	3273169	34.13
50-54	74565	323	0.0043	0.0214	94569	2026	467781	2796963	29.58
55-59	46068	316	0.0069	0.0337	92543	3120	454914	2329182	25.17
60-64	39472	486	0.0123	0.0597	89423	5341	433761	1874268	20.96
65-69	28333	614	0.0217	0.1028	84082	8642	398803	1440506	17.13
70-74	21337	726	0.0340	0.1568	75439	11828	347627	1041703	13.81
75-79	12209	659	0.0540	0.2378	63611	15126	280241	694076	10.91
80-84	5420	500	0.0923	0.3748	48485	18173	196993	413835	8.54
85+	2933	410	0.1398	1.0000	30312	30312	216843	216843	7.15
Total	1261753	5173					7684597		

Source: Data from Table A01-07, Table A06-01, Population Census Office，Liaoning Province, 2002

Table 6.14 Abridged Life-table for 5-year Age Intervals, Tieling Prefecture, Liaoning Province, 2000

Age groups	population	deaths	M_x	q_x	l_x	d_x	L_x	T_x	e_x
0	26088	165	0.0063	0.0063	100000	629	99434	7363089	73.63
1-4	108579	70	0.0006	0.0026	99371	256	396973	7263655	73.10
5-9	179497	56	0.0003	0.0016	99115	154	495190	6866682	69.28
10-14	228610	76	0.0003	0.0017	98961	164	494393	6371493	64.38
15-19	183189	114	0.0006	0.0031	98796	307	493214	5877100	59.49
20-24	204873	154	0.0008	0.0038	98489	369	491523	5383886	54.66
25-29	256063	267	0.0010	0.0052	98120	510	489324	4892363	49.86
30-34	303560	317	0.0010	0.0052	97610	508	486778	4403038	45.11
35-39	287422	437	0.0015	0.0076	97101	735	483668	3916261	40.33
40-44	240264	558	0.0023	0.0115	96366	1113	479049	3432592	35.62
45-49	243322	911	0.0037	0.0185	95253	1767	471851	2953544	31.01
50-54	168594	967	0.0057	0.0283	93487	2643	460826	2481693	26.55
55-59	109267	1070	0.0098	0.0478	90844	4342	443364	2020867	22.25
60-64	92221	1511	0.0164	0.0787	86502	6808	415491	1577503	18.24
65-69	72107	2191	0.0304	0.1412	79694	11253	370340	1162012	14.58
70-74	56675	2673	0.0472	0.2109	68441	14437	306114	791672	11.57
75-79	37598	2777	0.0739	0.3117	54004	16835	227932	485558	8.99
80-84	16869	1914	0.1135	0.4420	37169	16427	144777	257626	6.93
85+	8422	1548	0.1838	1.0000	20742	20742	112849	112849	5.44
Total	2823220	17776					7363089		

Source: Data from Table A01-07, Table A06-01, Population Census Office，Liaoning Province, 2002

Table 6.15 Abridged Life-table for 5-year Age Intervals, Chaoyang Prefecture, Liaoning Province, 2000

Age groups	population	deaths	Mx	qx	lx	dx	Lx	Tx	ex
0	34767	362	0.0104	0.0103	100000	1032	99072	7260348	72.60
1-4	133889	312	0.0023	0.0093	98968	918	394037	7161276	72.36
5-9	225942	73	0.0003	0.0016	98050	158	489855	6767239	69.02
10-14	293463	77	0.0003	0.0013	97892	128	489139	6277384	64.13
15-19	200356	151	0.0008	0.0038	97764	368	487899	5788245	59.21
20-24	222628	178	0.0008	0.0040	97396	389	486008	5300346	54.42
25-29	280272	268	0.0010	0.0048	97007	463	483880	4814338	49.63
30-34	329240	409	0.0012	0.0062	96545	598	481229	4330458	44.85
35-39	315193	487	0.0015	0.0077	95947	738	477888	3849229	40.12
40-44	285504	698	0.0024	0.0121	95208	1157	473150	3371341	35.41
45-49	239532	854	0.0036	0.0177	94052	1662	466104	2898191	30.81
50-54	158387	908	0.0057	0.0283	92390	2611	455422	2432087	26.32
55-59	129770	1212	0.0093	0.0456	89779	4097	438653	1976664	22.02
60-64	122524	1984	0.0162	0.0778	85682	6667	411743	1538011	17.95
65-69	93529	2642	0.0282	0.1319	79015	10424	369015	1126268	14.25
70-74	73320	3440	0.0469	0.2100	68591	14401	306952	757253	11.04
75-79	35981	2732	0.0759	0.3191	54190	17291	227721	450302	8.31
80-84	14276	1872	0.1311	0.4938	36899	18220	138945	222580	6.03
85+	6255	1397	0.2233	1.0000	18679	18679	83635	83635	4.48
Total	3194828	20056					7260348		

Source: Data from Table A01-07, Table A06-01, Population Census Office，Liaoning Province, 2002

Table 6.16 Abridged Life-table for 5-year Age Intervals, Huludao Prefecture, Liaoning Province, 2000

Age groups	population	deaths	M_x	q_x	l_x	d_x	L_x	T_x	e_x
0	26327	197	0.0075	0.0074	100000	743	99331	7592757	75.93
1-4	106113	52	0.0005	0.0020	99257	194	396638	7493426	75.50
5-9	175728	58	0.0003	0.0016	99062	163	494903	7096788	71.64
10-14	235889	71	0.0003	0.0015	98899	149	494123	6601884	66.75
15-19	164426	100	0.0006	0.0030	98750	300	493002	6107761	61.85
20-24	177993	150	0.0008	0.0042	98450	414	491217	5614759	57.03
25-29	208765	179	0.0009	0.0043	98036	419	489134	5123542	52.26
30-34	258541	313	0.0012	0.0060	97617	589	486613	4634408	47.48
35-39	248299	364	0.0015	0.0073	97028	709	483368	4147795	42.75
40-44	224812	476	0.0021	0.0105	96319	1014	479061	3664427	38.04
45-49	213480	632	0.0030	0.0147	95305	1400	473024	3185366	33.42
50-54	139347	608	0.0044	0.0216	93905	2027	464457	2712342	28.88
55-59	105399	724	0.0069	0.0338	91878	3102	451635	2247885	24.47
60-64	92386	1089	0.0118	0.0573	88776	5082	431173	1796250	20.23
65-69	78353	1597	0.0204	0.0970	83693	8116	398178	1365077	16.31
70-74	61044	2230	0.0365	0.1674	75578	12649	346265	966899	12.79
75-79	36698	2111	0.0575	0.2515	62928	15824	275082	620634	9.86
80-84	17327	1831	0.1057	0.4180	47105	19687	186304	345552	7.34
85+	9758	1680	0.1722	1.0000	27417	27417	159248	159248	5.81
Total	2580685	14462					7592757		

Source: Data from Table A01-07, Table A06-01, Population Census Office，Liaoning Province, 2002

Table 7.1 Life Expectancy for Liaoning's Prefectures and its Differences between City, Town, and County Populations, 2000

Prefectures	Population (10 000)	Life Expectancy at Birth (Prefectures)	Life Expectancy (City)	Life Expectancy (Town)	Life Expectancy (County)	Life Expectancy Difference between City and Town	Life Expectancy Difference between City and County
Dalian	589	76.86	79.15	76.64	74.18	2.51	4.97
Panjin	126	76.85	81.23	78.20	74.04	3.03	7.19
Huludao	258	75.93	80.72	79.20	74.53	1.52	6.19
Yingkou	230	75.62	77.60	76.26	74.33	1.34	3.27
Benxi	157	75.49	78.94	75.42	71.60	3.52	7.34
Anshan	358	75.42	76.51	76.76	74.03	-0.25	2.48
Liaoyang	180	75.04	77.99	76.16	73.11	1.83	4.88
Dandong	239	74.98	77.73	75.58	73.05	2.15	4.68
Jinzhou	308	74.43	78.66	74.61	72.67	4.05	5.99
Shenyang	720	74.06	75.06	75.04	71.88	0.02	3.18
Tieling	282	73.63	76.28	75.46	72.48	0.82	3.80
Fuxin	189	73.51	76.36	74.64	72.03	1.72	4.33
Fushun	226	73.35	74.03	73.62	71.71	0.41	2.32
Chaoyang	319	72.60	76.32	72.48	71.53	3.84	4.79
Total/Average	4181	74.81	76.91	75.64	73.00	1.27	3.91

Source: Life Tables 6.3 - 6.16

Table 8.1 Ranking Comparison of GDP per capita, and Life Expectancy for Prefectures, Liaoning Province

Prefectures	GDP per capita (Yuan)	Ranking by GDP per capita	Life Expectancy (Years)	Ranking by Life Expectancy
Panjin	20937.86	1	76.85	2
Dalian	18429.83	2	76.86	1
Anshan	15443.08	3	75.42	6
Shenyang	14988.66	4	74.06	10
Fushun	9064.91	5	73.35	13
Liaoyang	8647.82	6	75.04	7
Benxi	8516.64	7	75.49	5
Yingkou	6911.28	8	75.62	4
Dandong	6906.90	9	74.98	8
Jinzhou	6126.24	10	74.43	9
Huludao	5708.85	11	75.93	3
Tieling	4000.83	12	73.63	11
Fuxin	3369.06	13	73.51	12
Chaoyang	2594.11	14	72.6	14

Source: Kou, 2009 and Table 7.1

Note: GDP per capita is based on data of 1999 and Life expectancy is for the year 2000

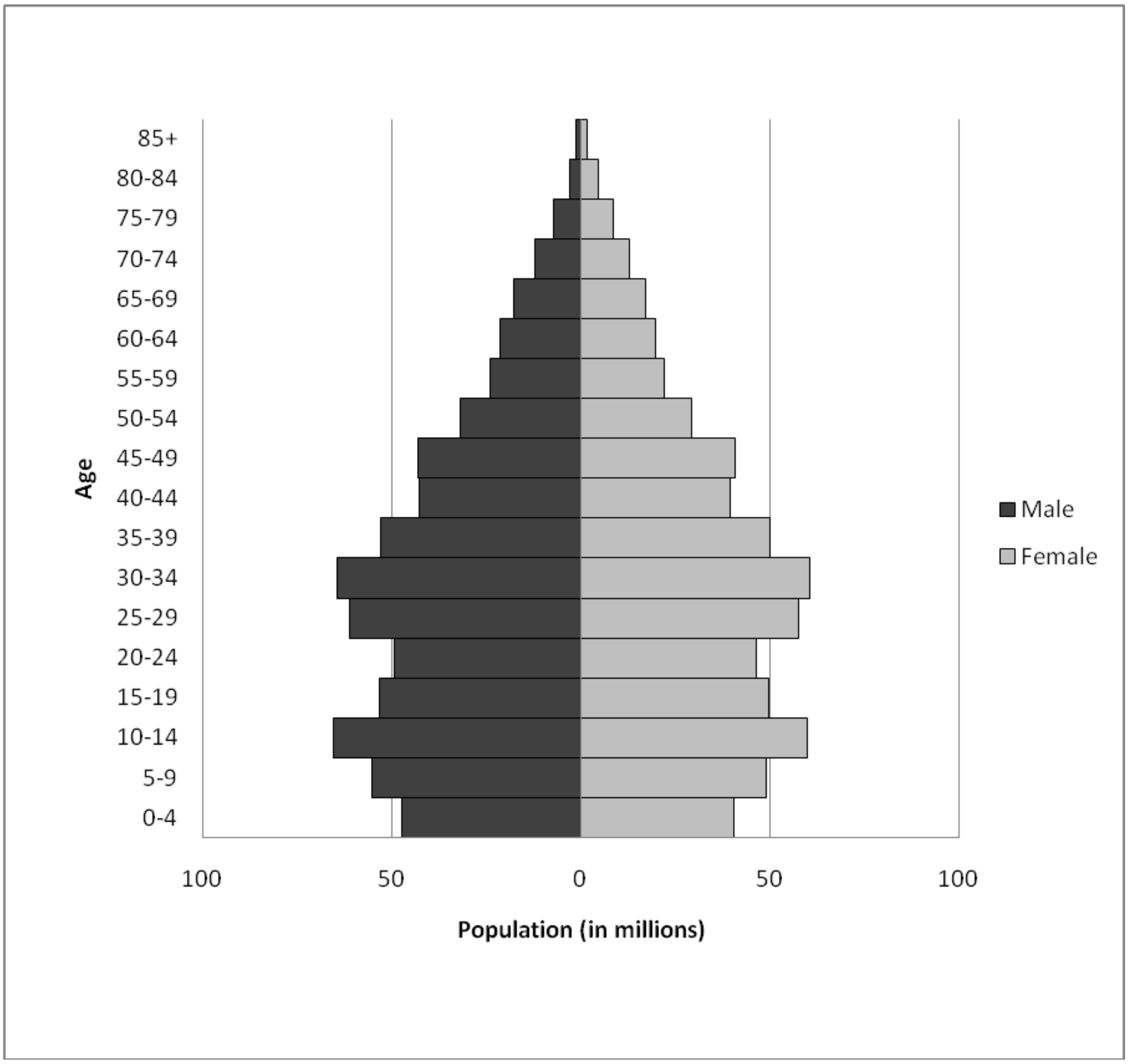


Figure3.1 Population Pyramid of China, 2000

Source: Data from U.S. Census Bureau, International Data Base, 2000

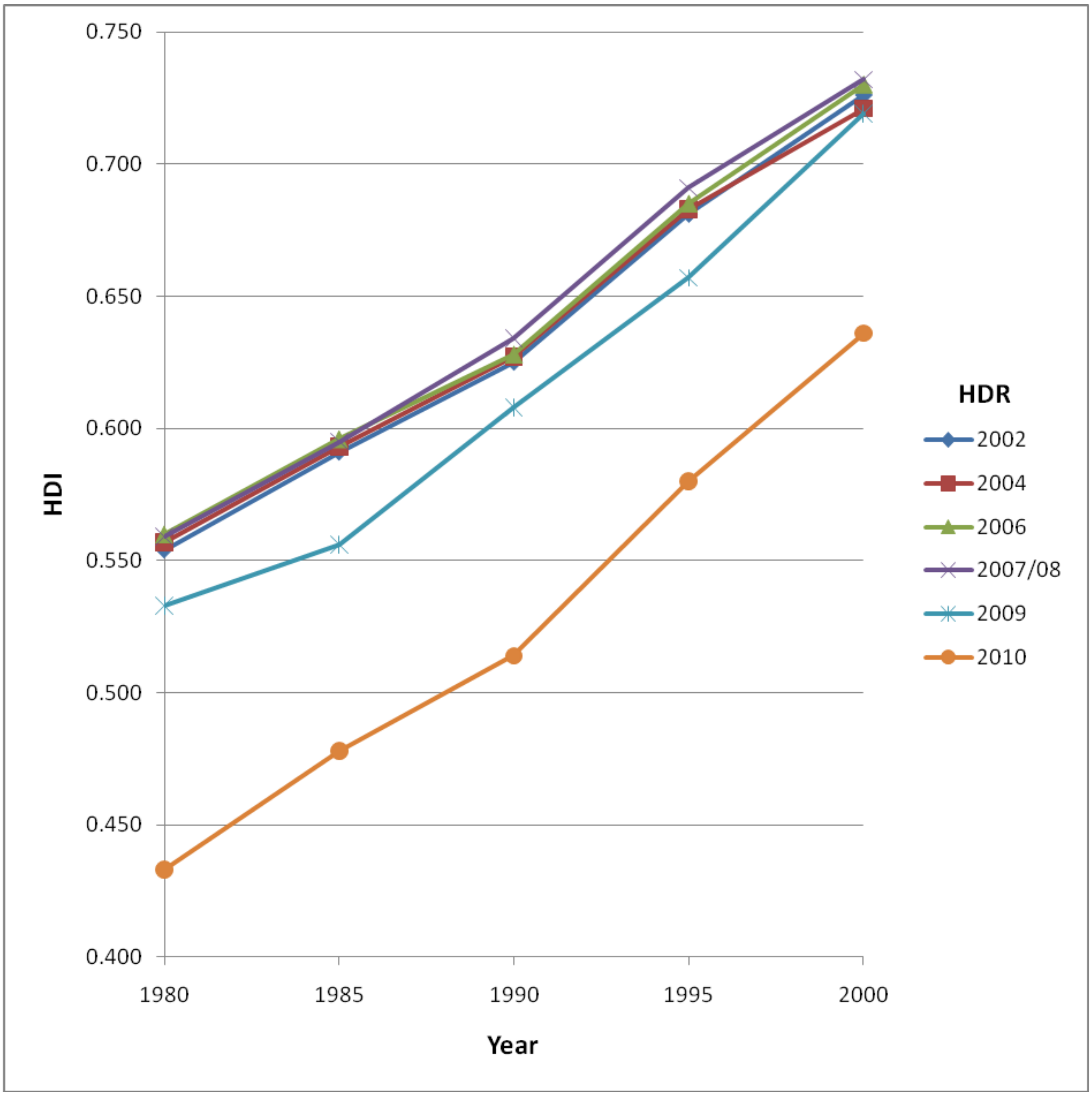
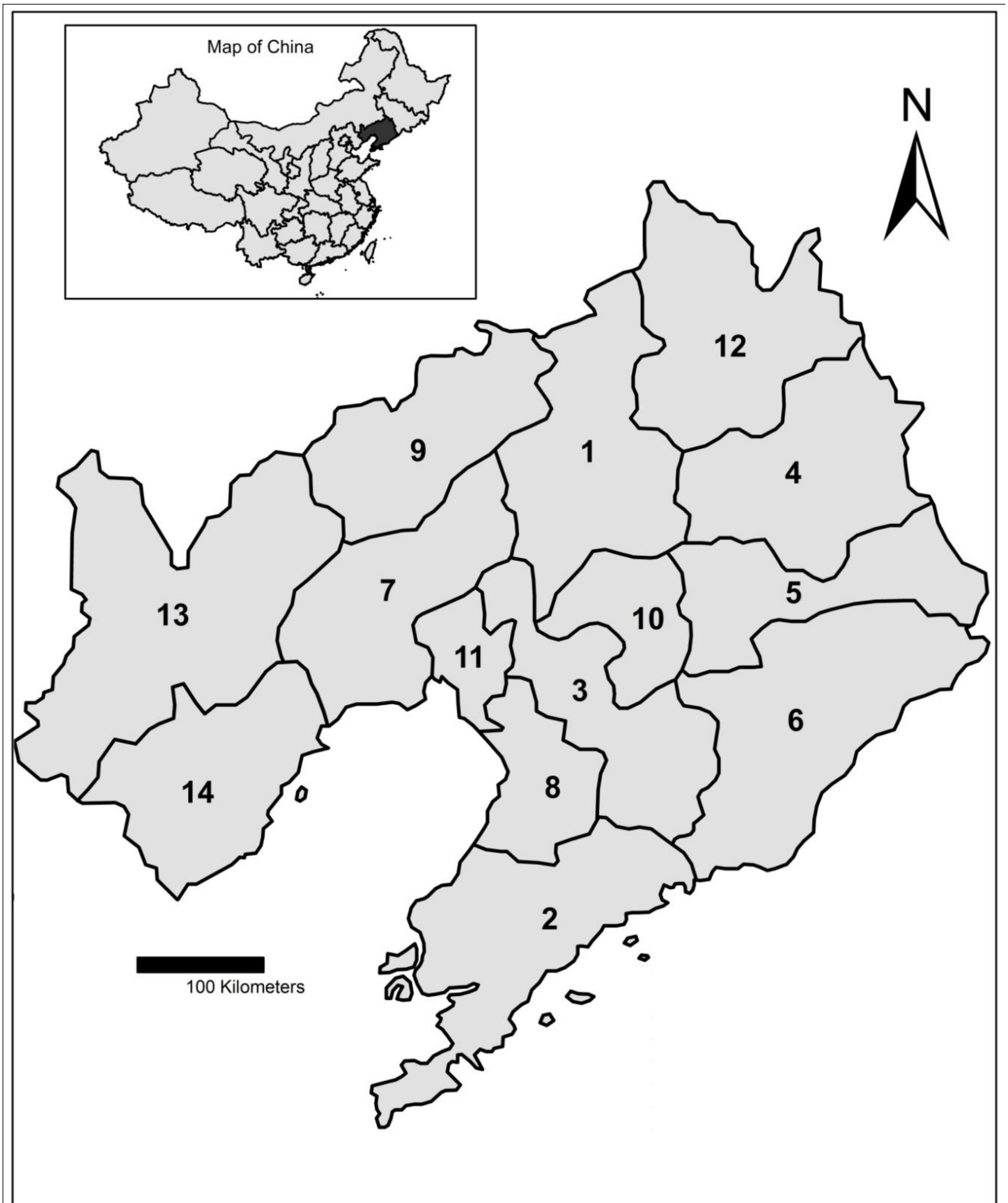


Figure 4.1 Discrepancies of HDI Values, 1980-2000, from Various HDRs

Source: Table 4.1



1	Shenyang	4	Fushun	7	Jinzhou	10	Liaoyang	13	Chaoyang
2	Dalian	5	Benxi	8	Yingkou	11	Panjin	14	Huludao
3	Anshan	6	Dandong	9	Fuxin	12	Tieling		

Figure 6.1 Prefectures of Liaoning Province, 2010

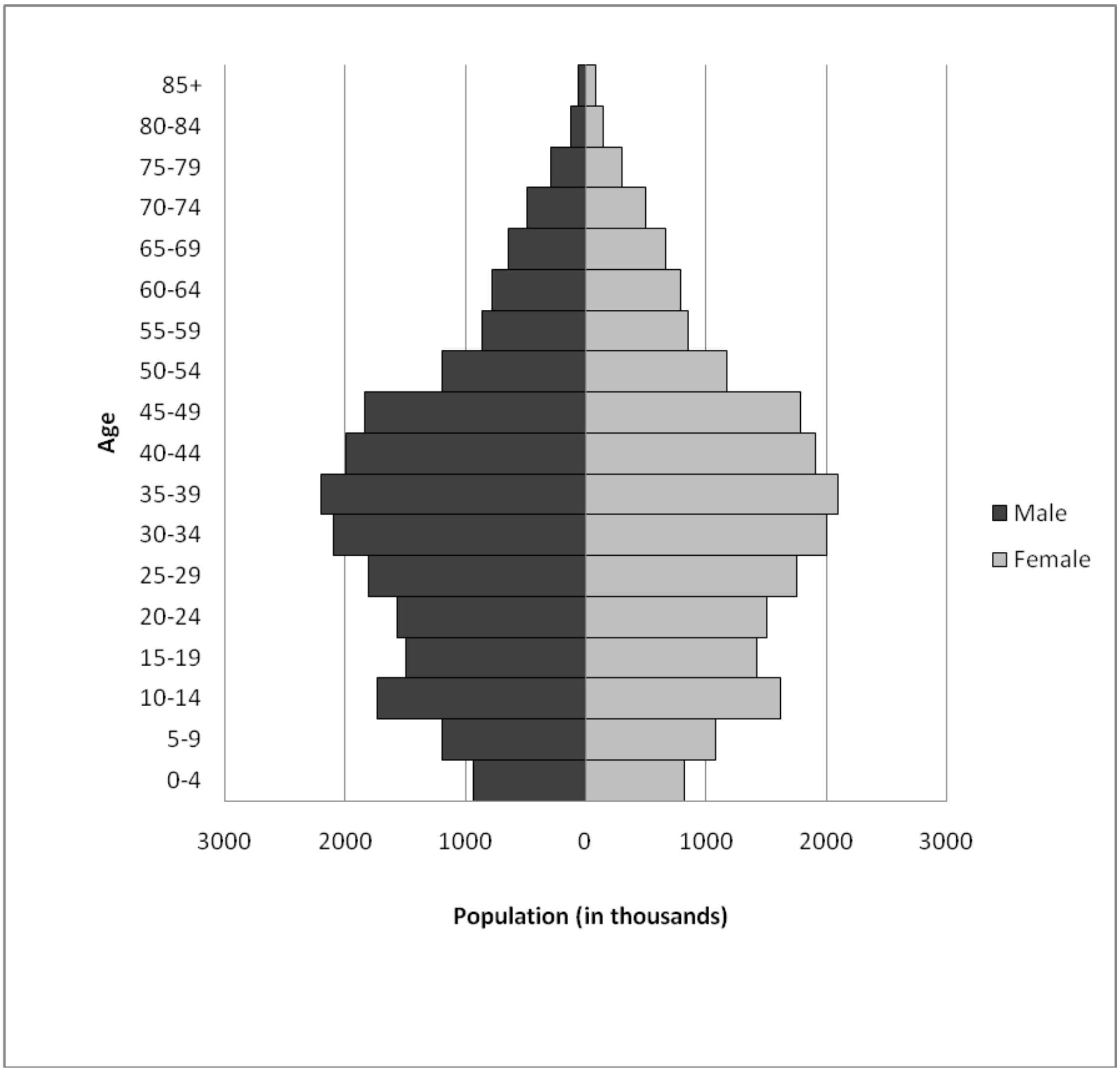


Figure 6.2 Population Pyramid of Liaoning Province, China, 2000

Source: Population Census Office, Liaoning Province, 2002

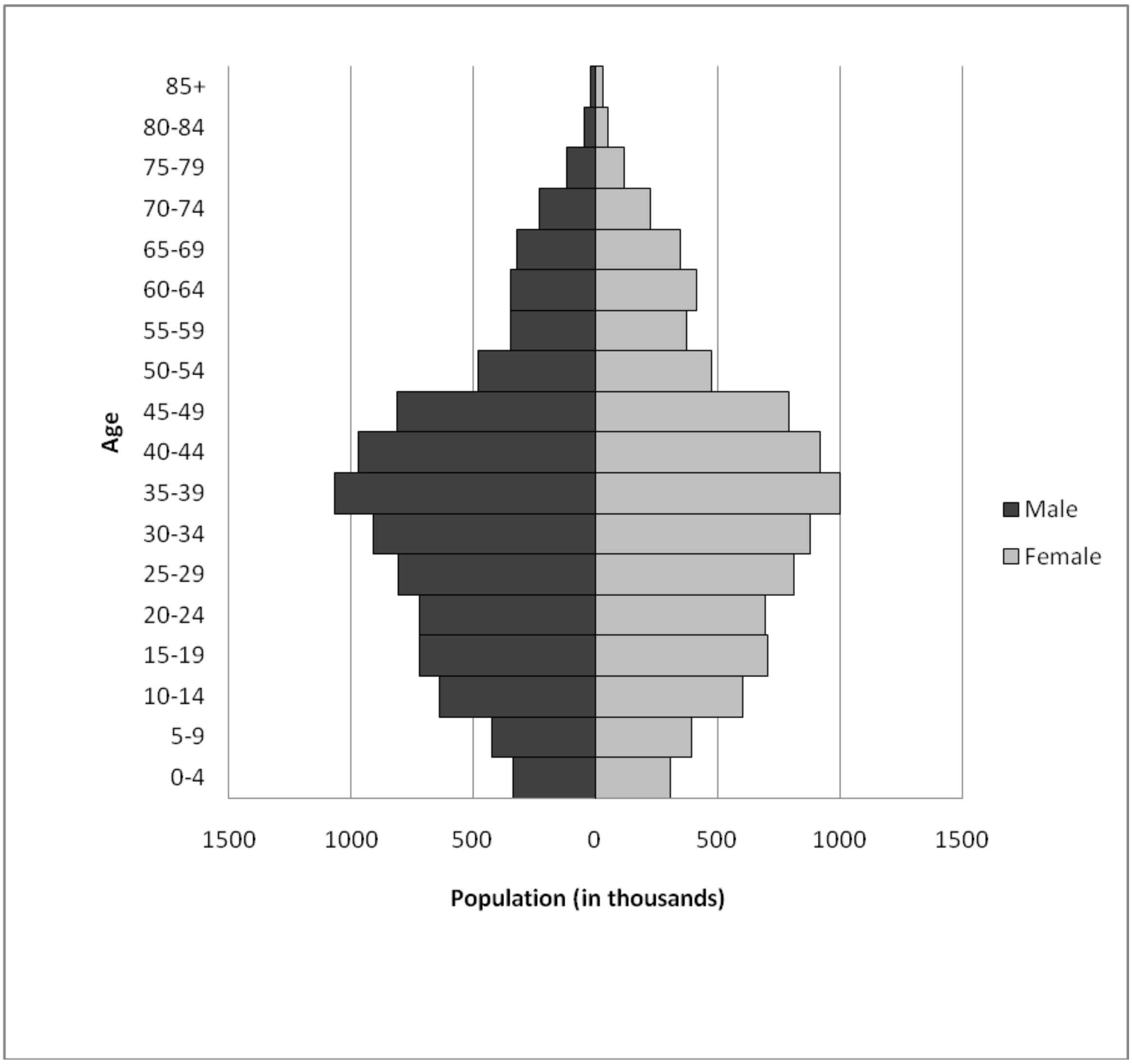


Figure 6.3 City Population Pyramid of Liaoning Province, China, 2000

Source: Population Census Office, Liaoning Province, 2002

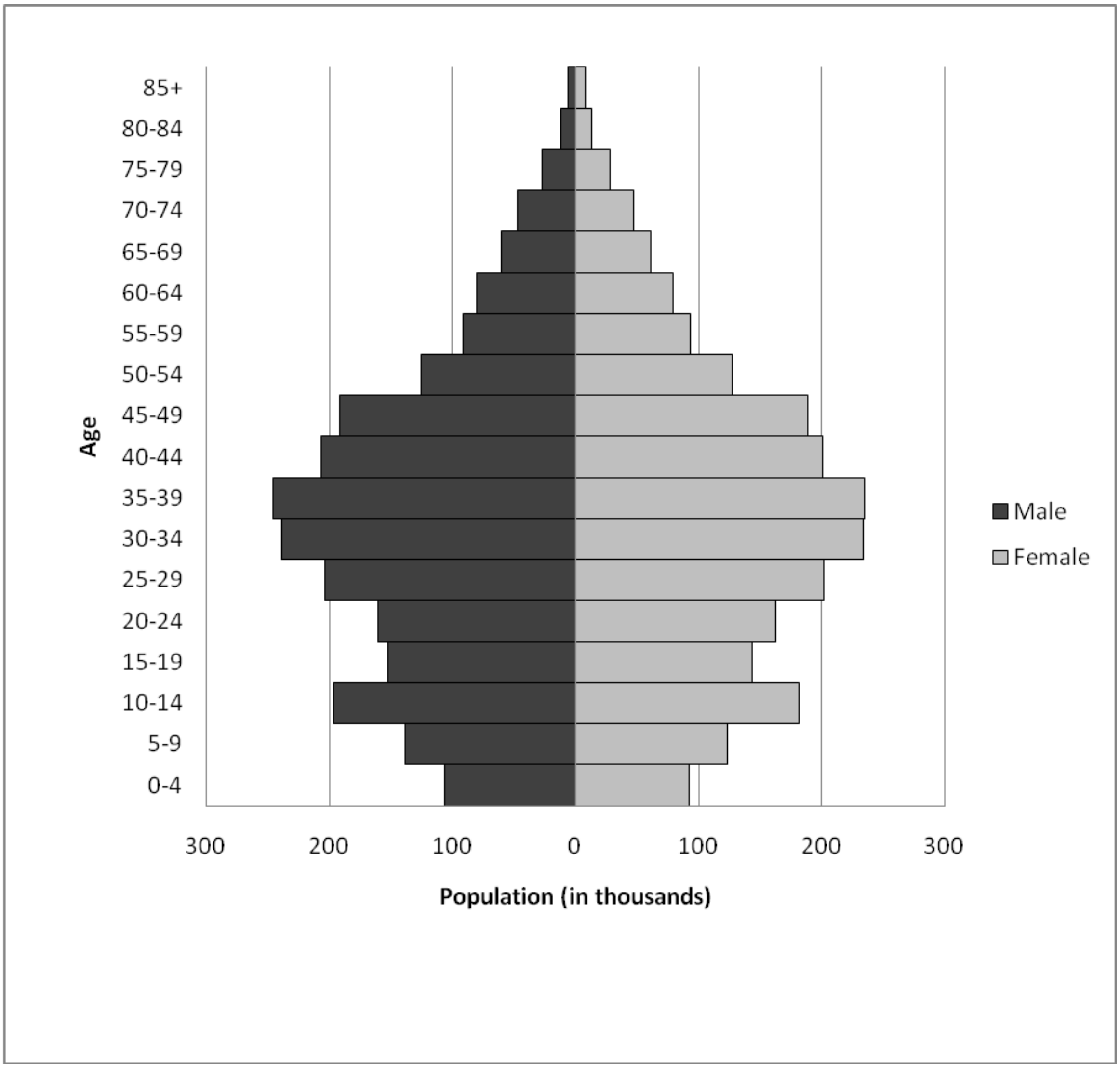


Figure 6.4 Town Population Pyramid of Liaoning Province, China, 2000

Source: Population Census Office, Liaoning Province, 2002

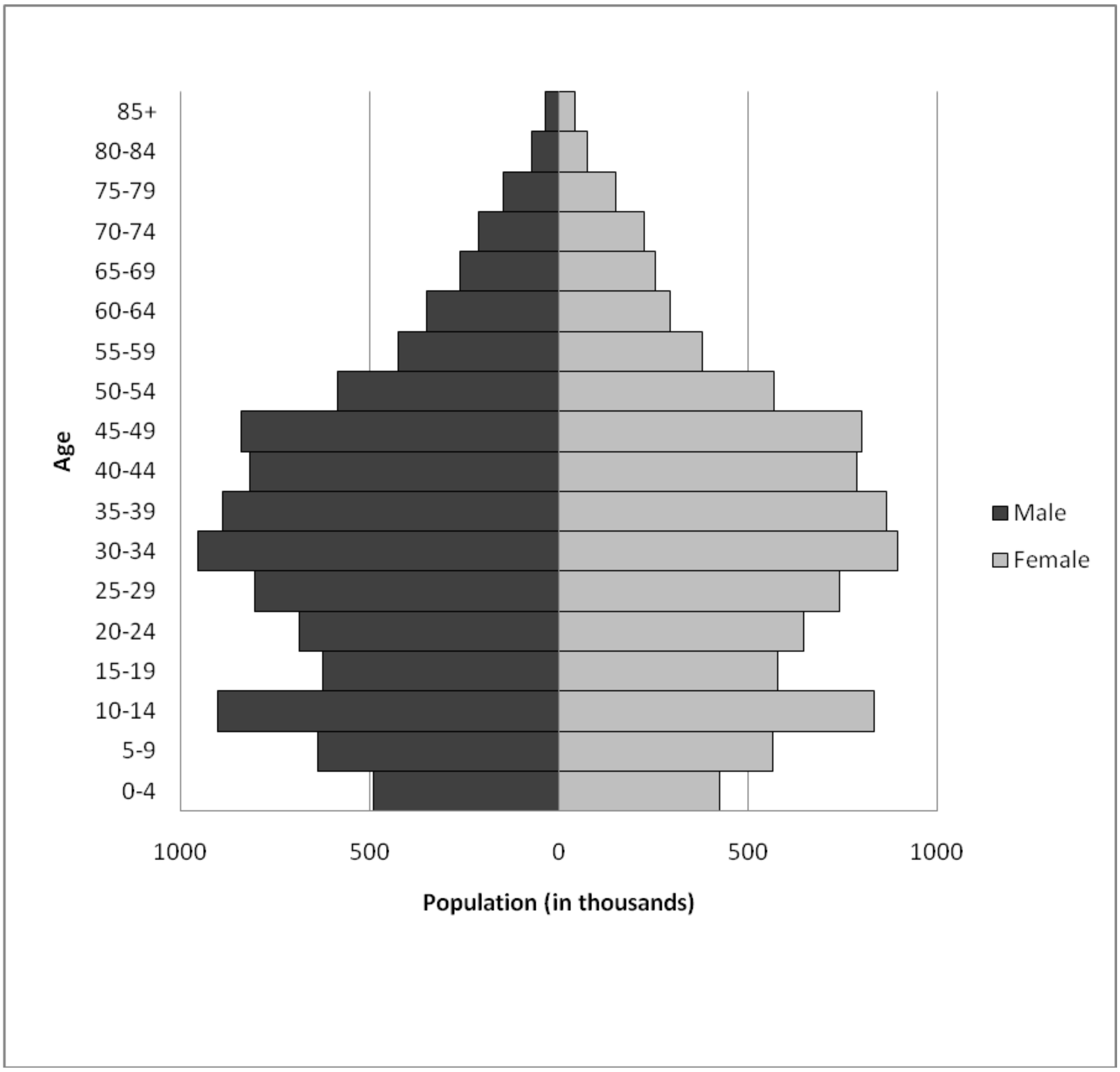


Figure 6.5 County Population Pyramid of Liaoning Province, China, 2000

Source: Population Census Office, Liaoning Province, 2002

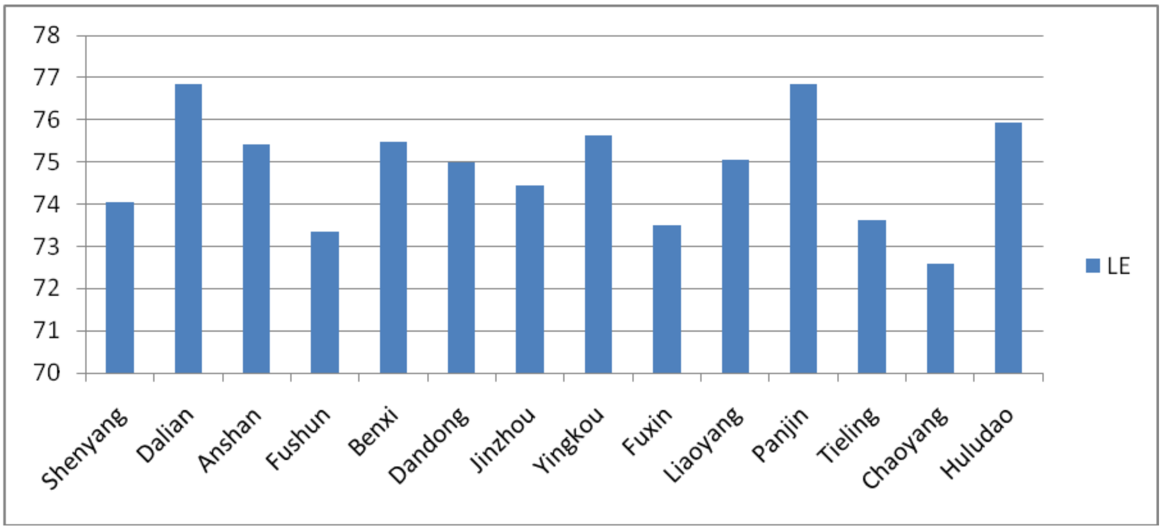


Figure 7.1 Life Expectancy for Liaoning Prefectures, 2000

Source: Table 7.1

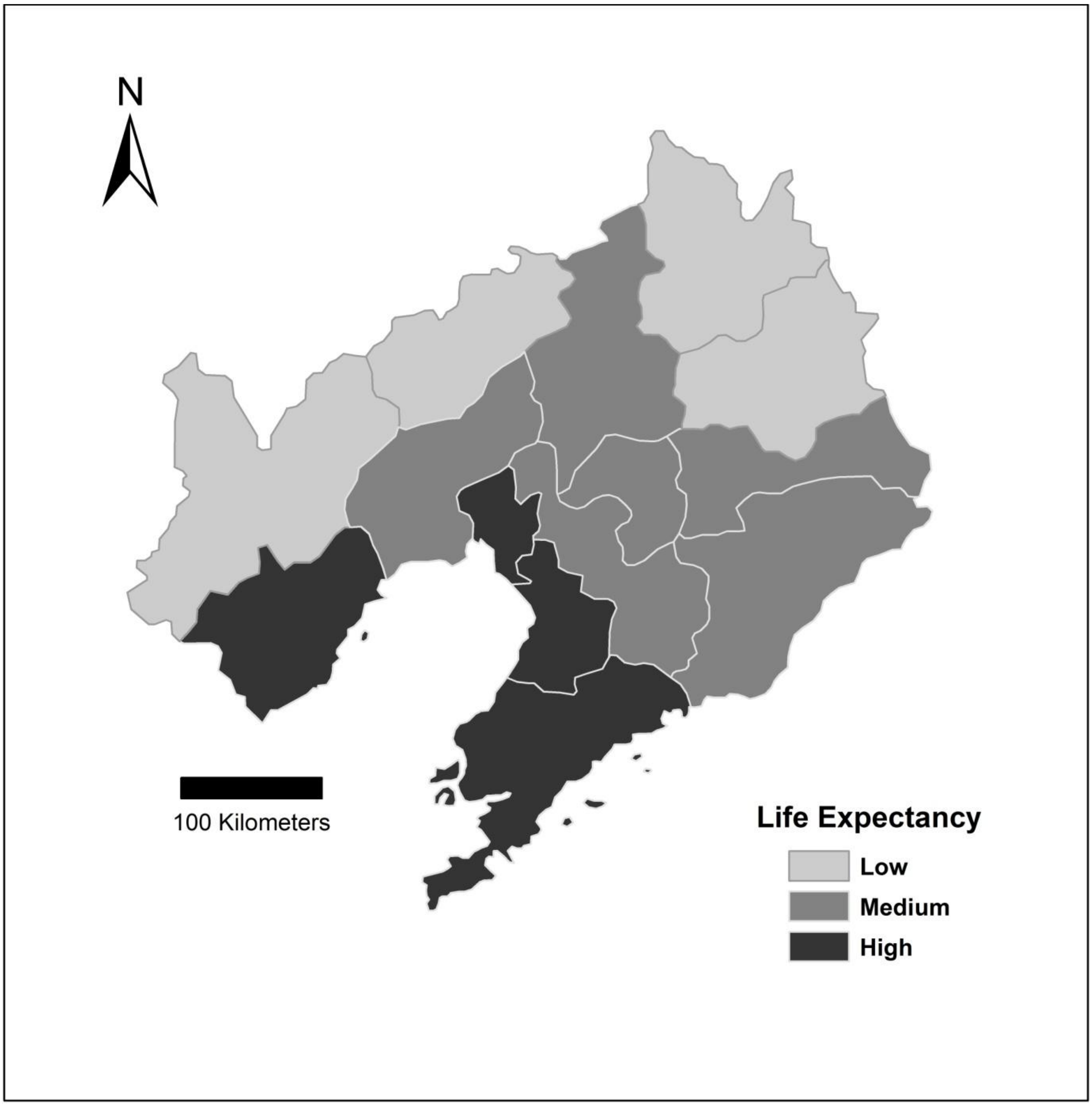


Figure 7.2 Geographic Distribution of Life Expectancy, Liaoning Province, China, 2000

Source: Table 7.1

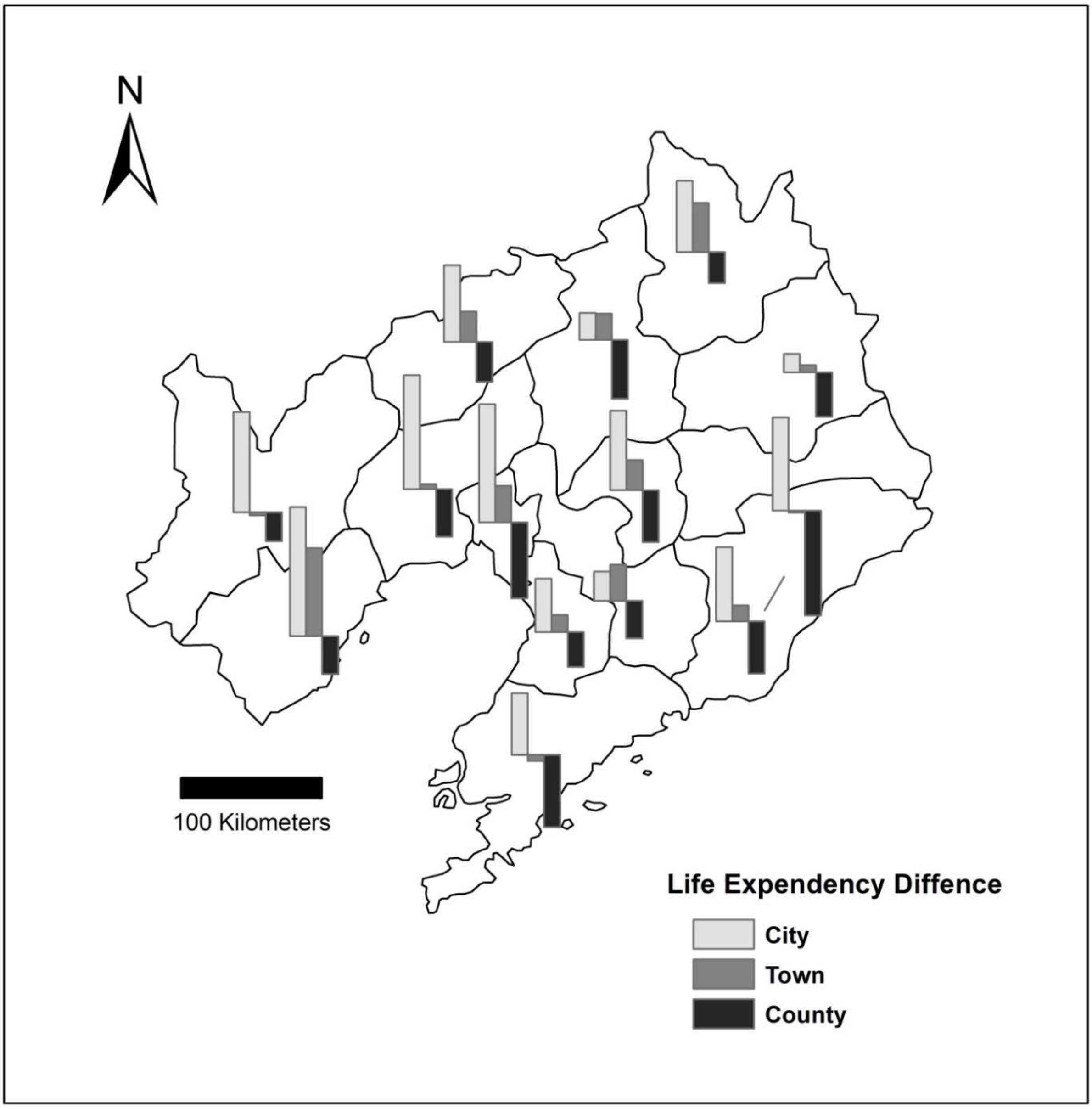


Figure 7.3 Life Expectancy Differences between City, Town, and Country Population, Liaoning Province, China, 2000
Source: Table 7.1

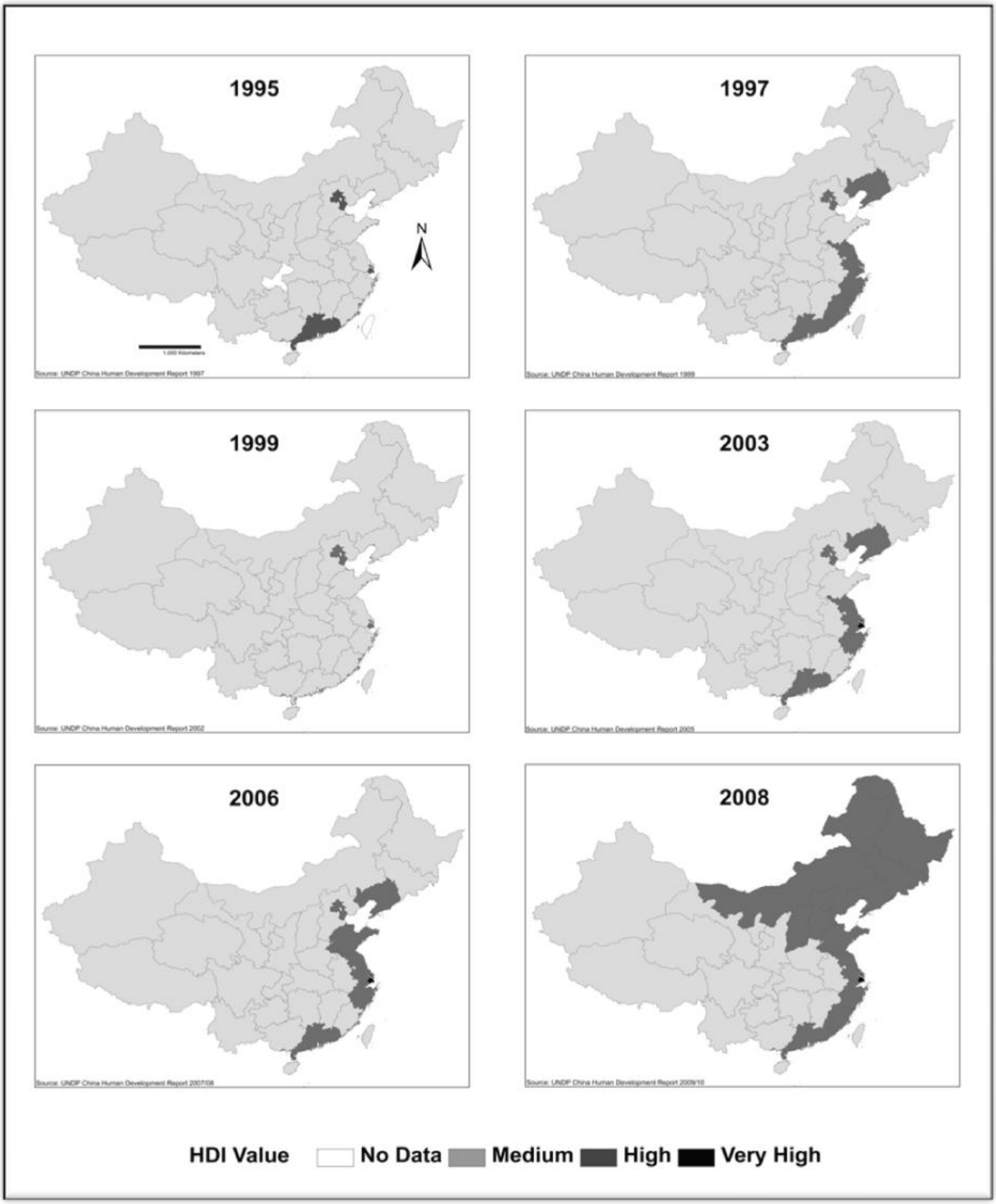


Figure 8.1 Spatial Distributions of the HDI Values, Regions, China, 1995-2008

Source: Table 4.4 – 4.10

Note: Regions of China consist of provinces, autonomous regions and municipalities under direct control of the central government. Taiwan and the special administrative regions of Hong Kong and Macau are excluded. Values for 1995 do not include Chongqing as it became a municipality under direct control only in 1997.

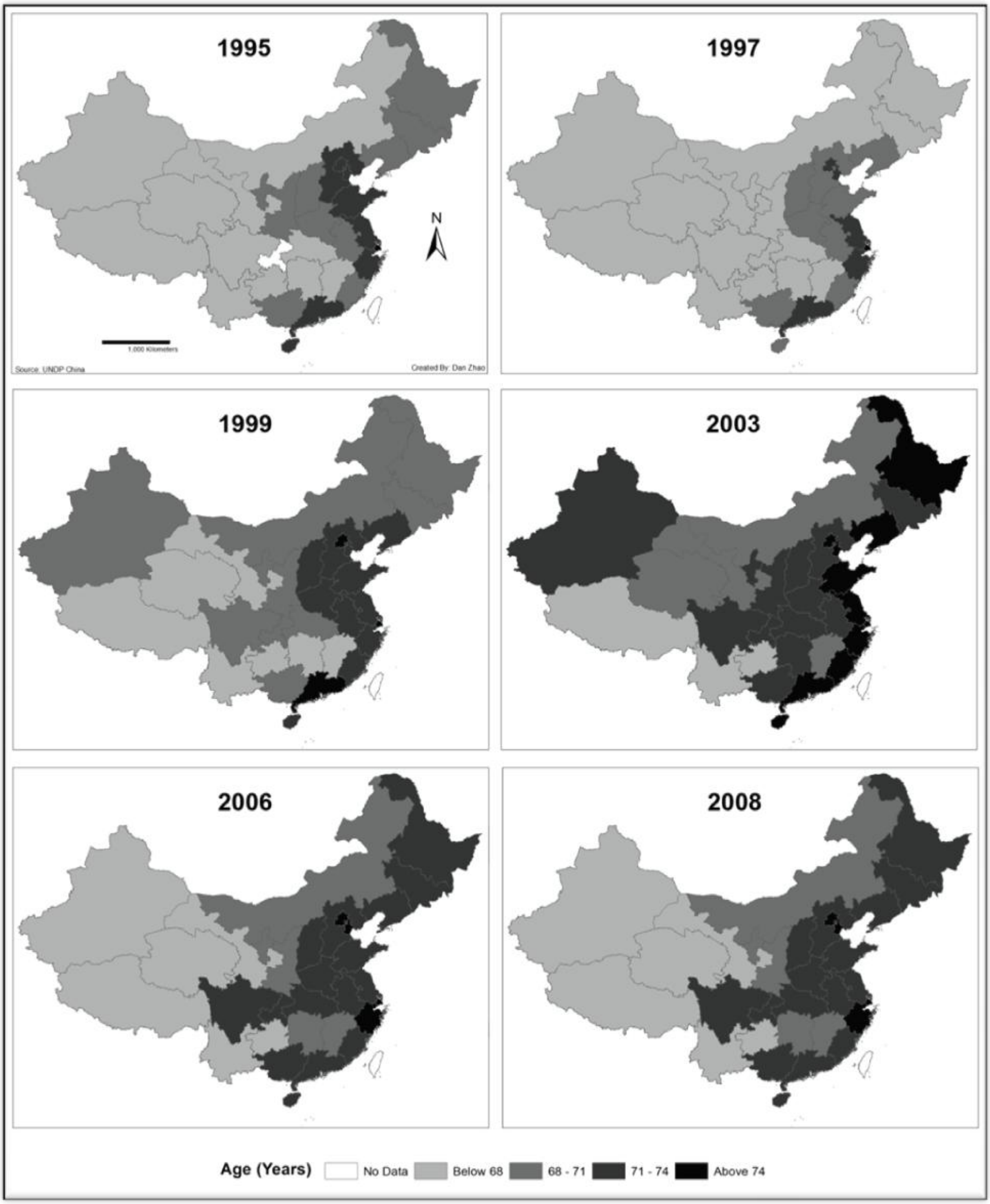


Figure 8.2 Spatial Distributions of Life Expectancy, Regions, China, 1995-2008

Source: Tables 4.11 – 4.17

Note: See note for Figure 6.3

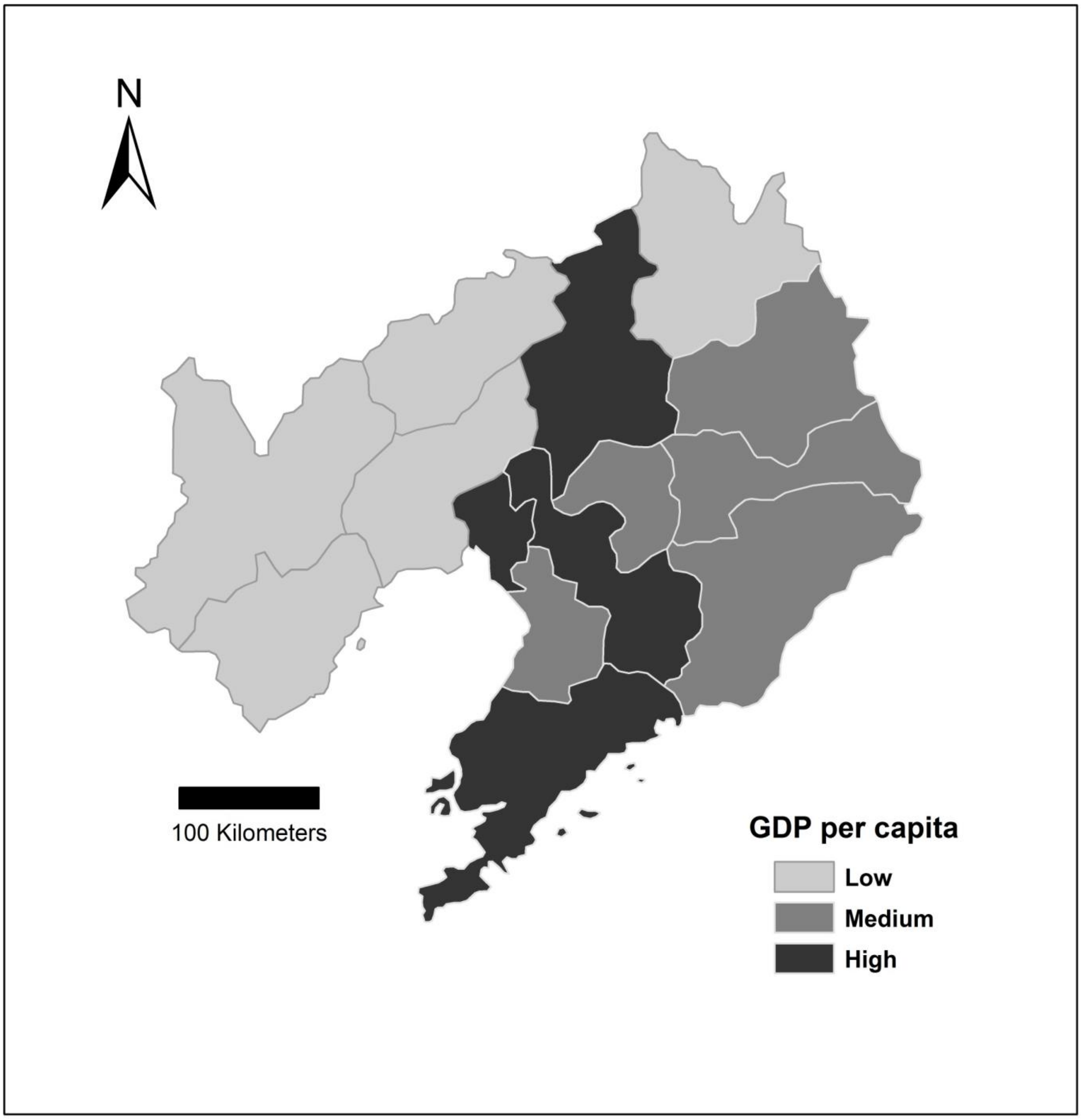


Figure 9.1 Geographic Distribution of GDP per capita, Liaoning Province, China, 2000

Source: Table 8.1